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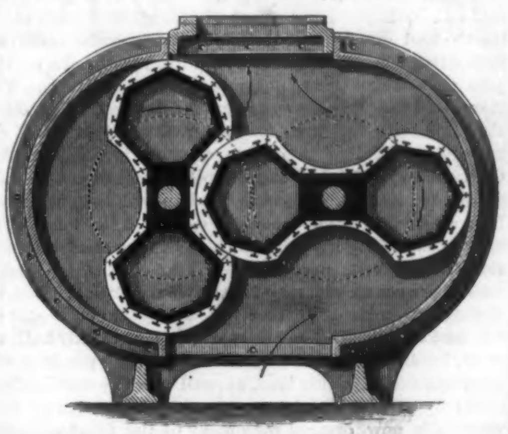
IMPROVED FORCE BLAST ROTARY BLOWER.

We present herewith a fine engraving of the interior of the setting up room of one of the best known of our Western manufactories, the works of Messrs. P. H. and F. M. Root, at Connersville, Ind., an establishment devoted to the production of the Root rotary blower. From the illustration, the reader will perceive not only the excellent internal arrangement of this extensive workshop but also be able to compare the different forms of the standard machine which there receives its finishing touches. On the wide application and manifold uses of devices having for their object the production of a continuous and powerful blast of air, it is hardly necessary here to enlarge. As a class they find employment in nearly every industry, and, contrasted with their prototypes, the hand bellows, the high speed fan, and other crude conceptions of former days, mark the progress of modern mechanical science as clearly and strongly as the steam engine or telegraph.

Ranging from the colossal apparatus, capable of delivering a current of 100,000 cubic feet of air per minute, to the almost toy-like implement constructed for the delicate operations of mechanical dentistry, the Root blower possesses, in all its various forms, certain advantages which have been the means of its successful introduction in many of the largest establishments in this country and Europe. Among these points of superiority, as claimed by the manufacturer, may be noted the facts that a positive or force blast is produced with great regularity and reliability; that fifty per cent of the power required to drive fans is saved by reason of the slow speed on which the Root blower does its work, from 100 to 200 revolutions per minute, giving a blast which requires at least 2,000 to 3,000 revolutions of the fan (a fact demonstrated, we are informed, by repeated and careful experiment); that, when applied to the cupola, more perfect and uniform combustion is produced, securing rapid melting, softer and better castings, and a material economy in the amount of fuel consumed; and, lastly, that the machine itself is of great durability, consequent upon its substantial construction and slow motion causing much less wear upon the belting and running parts.

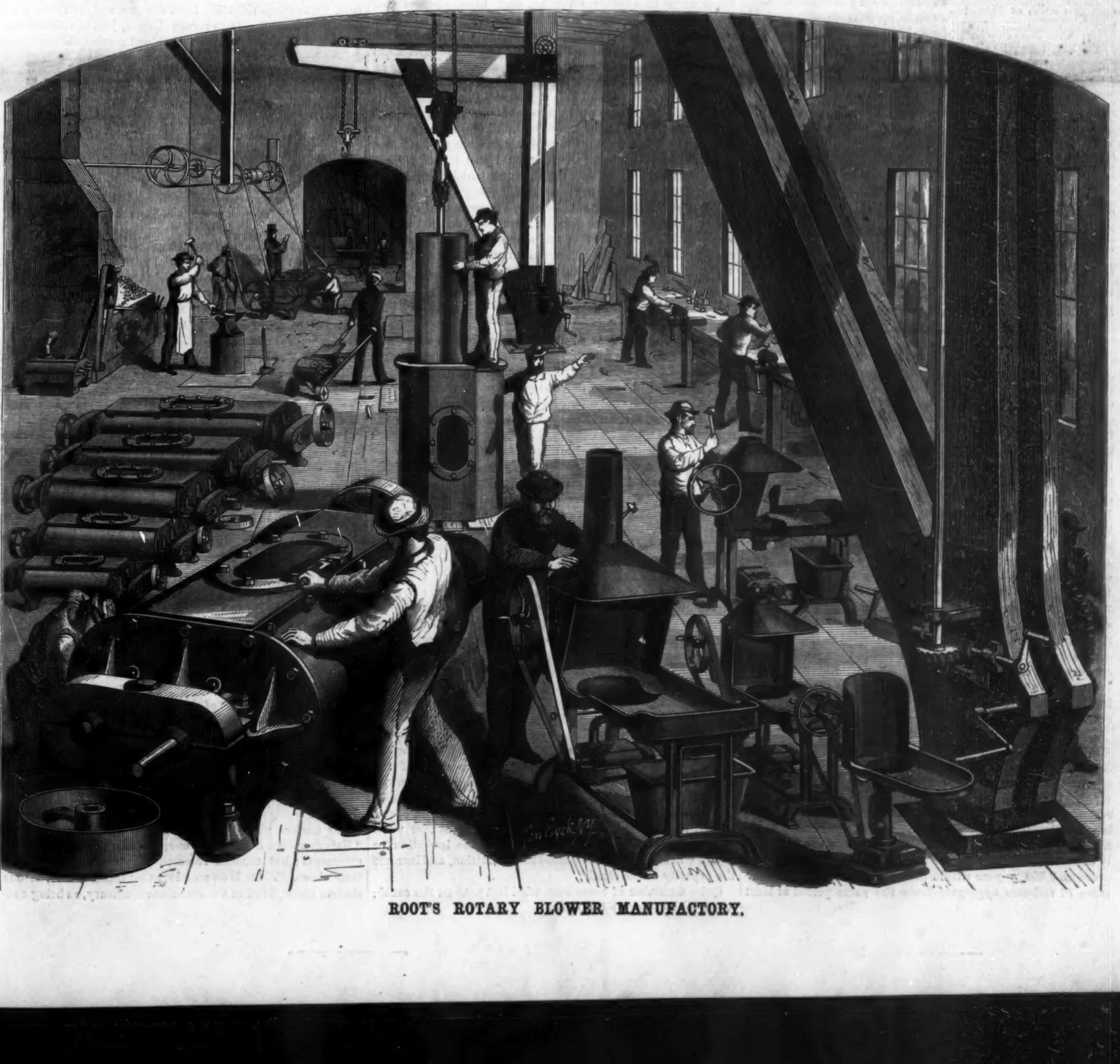
Fig. 2



Referring to the mechanical arrangement, it should be noticed that the apparatus is built with a pulley at each end and one on each of its two shafts, being driven with one open and one cross belt. The power, instead of being transmitted from one shaft to the other through cog wheels, is applied directly to each shaft, and the stress and wear is almost entirely removed from the gearing, which serves only to keep the revolvers in their proper relative position. The blower, as will be seen from the sectional view, Fig. 2, does not operate on the principle of a fan, that is, by imparting momentum to the air by running at a great velocity, but by regular displacement of the air at each revolution, whether driven fast or slow; in this respect it resembles an air pump. The current entering the case is closed in by the wings of the revolvers, absolutely confined and forced forward until brought to the eduction pipe, where it is discharged. There can be no backward escapement of the air after it once enters the case, the contact being kept up at all times in the center of the blower, between the pistons or revolvers. The external case is made of cast iron, and the cylindrical parts are bored out. The head plates are faced off on a boring mill especially arranged for the purpose.

The blower is adapted to all purposes where either blast or exhaust is required, such as founderies, smith shops, or rolling mills; it is suited for the ventilation of public buildings, mines, and tunnels of any magnitude. As a gas exhauster, it has been adopted by many of the leading gas companies in the United States and, besides, has found employment in woolen, paper, and other manufactories. One of its most notable applications was that of furnishing the blast for driving the passenger car of the Beach Pneumatic Transit Company, in their experimental underground railway tunnel under Broadway, in this city. The immense blower there employed delivers, when worked at maximum speed, a volume of 100,000 cubic feet of air per minute.

The subject of our article is also largely employed abroad, and is manufactured in several of the principal industrial centers of Europe. We learn that it has been introduced in the well known steel works of Herr Krupp, at Essen, Prussia, and in the equally celebrated works of Messrs. Sir Joseph Whitworth & Co., Manchester, England, and in nearly



ROOT'S ROTARY BLOWER MANUFACTORY.

all the Bessemer steel works of Great Britain, nearly one hundred being in use in the city of Glasgow alone. In all, about one thousand are in use in England at this time, and a large number on the continent. By the aid of one of these machines Mr. W. Ireland, the noted iron founder, made a 250 tun anvil block, probably the largest casting ever made, melting the iron at the rate of thirty tuns per hour, and completing the entire work in a little over eight hours.

This blower received the highest award conferred on machines of this class at the Paris Exposition of 1867. We notice that it is on exhibition in the American department at the exposition now being held in Vienna. It has also received the highest awards for three years successively at the Fair of the American Institute of this city, and also the highest premium at all the industrial expositions held in the city of Cincinnati, Ohio.

For further information address the inventors and proprietors at Connersville, Ind., or S. S. Townsend, general agent, 31 Liberty street, New York city.

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NEW YORK, SATURDAY, JUNE 28, 1873.

Contents:

(Illustrated articles are marked with an asterisk.)

END OF ANOTHER HALF YEAR.

With this issue a number of six months' subscriptions, which commenced with the year, will end. We hope all such subscribers will renew, and it will gratify the publishers if each would send a new subscriber. It is just as easy to remit $3 for two names for six months as half the amount for one name, and it suits the publishers much better. Remittance by postal order is the safest and best. Address MUNN & Co., 37 Park Row, New York city.

NECESSITY FOR SANITARY REFORM.

In another column of this issue will be found a continuation of our series of "Sanitary Notes," a paper on the subject of "Sewerage and Sewage," devoted mainly to a brief description of the various projects for the utilization of refuse filth, so as to transform it from a source of expenditure to one of valuable profit. In large cities the question of obtaining the fertilizing matter from the material, though in itself one of no small importance, is, owing to the vast quantities of the latter produced, subordinate to the problem of disposing of the noxious substance in such a manner that it shall not breed disease or nurture pestilence in the narrow and confined limits of thickly populated districts. It need not be pointed out that without an effective system of sewers, which not only convey away the filth but also form complete drains for every portion of the city, the removal of this waste is impossible. Here, where the main conduits are on a level below the high water mark of the rivers into which they empty, or are distorted to convey their contents (hypothetically) up hill, or where the branch sewers connect with mains set on a superior level, nothing else is to be expected than a stagnation of contents in the tubes, and in the former instance their reflux through the action of the entering tides.

Bad as such a state of affairs is, and pressing as is the invitation which it holds out to epidemic and zymotic diseases, it nevertheless obtains in New York and probably many other cities of which the growth has been proportionally rapid. Some of the daily journals, notably the *World*, have recently taken up the subject, and the information published is well calculated to arouse the citizens of the metropolis to a sense of the insidious dangers to which they are constantly exposed. The death rate from zymotic diseases alone averages 9,000 a year within the corporate limits, and the cases of sickness aggregate from the same period at least 100,000. It requires but a casual stroll through certain portions of the city to determine the reasons for this fearful mortality.

Probably the action of the tides, as above described, forcing the filth back and often out of the street culverts, is a prolific source of the miasm of the lower lying districts. It is but a few days since that, in passing through a street contiguous to the Hudson river, we ourselves observed that, after a heavy rain and at high tide, the gutters and roadway in the neighborhood of the openings were flooded over a considerable area, and to several inches deep, with a black, horrible liquid, in which, despite its disgusting odor, the street urchins were holding especial revel. For such glaring faults as this there is clearly no excuse, even if any in deprecation be admitted for the negligence to which the more hidden defects of the uptown sewers must be ascribed. Cellars are flooded, and the soil, permeated with filth, giving rise to deadly mephitic gases, makes the locality a hot bed for disease, originating that scourge of children, *cholera infantum*, and also the rheumatism, scrofula, fevers, and innumerable pulmonary complaints of adults. In the new and manufactured portion of the city, in the neighborhood of Central Park and above, the condition of matters, though less apparent, is not much better. Some years since General E. L. Viele published a map of Manhattan Island, showing the lead of the natural water courses and ponds, the beds of which, like that upon which the Tombs or city prison now stands, were quagmires and soaking bogs. This map disappeared, but was resurrected by the Citizens' Association in 1865, and from its topography the origin of the maladies prevailing in certain quarters is readily traced. Old marshes, which, in the overwhelming desire to raise grades and make streets, were filled up with sand and stone, have asserted their existence and converted the land into a sponge, absorbing the filth which flows from the faulty sewers. In the upper portion of our city, even at the present time, there are streets, raised far above the normal grade, enclosing lots on the bottom of which stagnant pools still exist; and we can recall localities which, now thickly built up, were, hardly ten years since, sites of skating ponds of considerable extent. This land, as well as whole districts indicated by General Viele's map as the former beds of water courses, is now covered with many of the finest residences in the city, the owners of which, though experiencing sickness in their families, little suspect the hidden cause to which the prevalence of disease is due.

We notice with gratification a revulsion of opinion against filling in, as a means of reclaiming ground from bogs and swamps. The health authorities of Brooklyn have already taken steps in another direction, and have appropriated funds to pump off the water from submerged land before raising the grade. This, we think, is the wisest course the Health Board can pursue. Burying a nuisance out of sight is not abating it, and merely covering up so formidable an enemy to public health renders it doubly dangerous by concealing its existence until it becomes recognized through its deadly effects. The pumping operations can be accomplished very expeditiously, while the filling up process takes a great deal of time; and the expensive nature of the latter, for material, labor, and cartage, would cost the city or the owners a much greater sum than that for which the property when filled in could be sold.

We need rapid transit, and our present system of docks is a disgrace to any civilized people; but great as are both our wants in this direction, they are exceeded by the urgent necessity which exists for a thorough overhauling and, if need be, entire alteration of our sewerage.

RENEWAL OF THE REWARD OF ONE HUNDRED THOUSAND DOLLARS.

The Legislature of the State of New York has recently renewed, for the period of one year, the offer of one hundred thousand dollars reward for improvements in canal navigation. This will be good news to scores of inventors.

The law making the offer of this large reward was originally passed in 1871, and the text thereof was given in the SCIENTIFIC AMERICAN of May 6 in that year. It provides for the payment of one hundred thousand dollars to the introducer of a plan, for navigating the Erie canal in this State, which shall prove on actual trial to be better and more economical than the existing method of towage by horses. The following are the chief requirements of the law:

A Board of Commissioners is appointed, consisting of George B. McClellan, Horatio Seymour, Erastus S. Prosser, David Dows, George Geddes, Van R. Richmond, Willis S. Nelson, George W. Chapman, William W. Wright, and John D. Fay, whose duty it is to practically test and examine all inventions that may be submitted to them, by which steam, caloric, electricity or any motor other than animal power can be practically and profitably applied to the propulsion of boats upon the canals. Such tests and examinations are to be confined to the season of canal navigation in the year 1873, and the Commissioners are required to demand that the competing inventions shall be tried practically upon the canals at the expense of the applicants; that the boat shall, in addition to its weight of machinery and fuel, be able to transport at least 200 tuns of cargo, be able to run at a speed of not less than three miles per hour, be easily stopped and backed by its own machinery, which should be simple, economical, and durable, and readily adapted to the present canal boats. Lastly, the law requires before an award is made that "the Commissioners shall be fully satisfied that the invention or device will lessen the cost of canal transportation, and increase the capacity of the canal."

Quite a number of boats were tried last year on the canal; and in our paper of February 15, 1873, will be found a brief description of their construction and performances.

Individuals who propose to compete for the prize should bear in mind that it is not simply the propulsion of the boat ahead that is required. It is not only the propulsion, but the steerage, rapid and economical handling of the vessel when in the canal. It is easy enough to drive a canal boat in open water by steam power, faster and cheaper than by horse towage. But to do so in a narrow canal, where the stoppages are frequent, the water shallow, the delays considerable, the boats constantly passing or repassing or dashing into each other, crowding together, jamming fast, etc., is a difficult problem. Evidently the boat should be provided with a variety of appliances to meet and promptly overcome the various exigencies to which it is to be subjected. It should have power to move laterally as well as longitudinally, at the will of the commander, and should have facilities for quickly anchoring and getting under way. Inventors will do well, therefore, to turn their attention to other things besides the mere form of the propellers. These have been invented already by the hundred, and little or no advantage has been secured from any of them. A velocity of only three miles per hour is needed, and this the ordinary propelling devices will easily supply.

The dimensions and other particulars of the Erie canal are as follows: Depth, 7 feet; width at top, 70 feet; width at bottom, 56 feet; length, 345 miles; number of locks, 72. The locks are 110 feet in length over all, admitting boats 96 feet long. The width of the locks at the surface of the water is 18 feet, and at bottom 17 feet 4½ inches. The largest boats used on the canal are 96 feet long by 17 feet 8 inches beam, with a depth of 9 feet. Such boats draw 6 feet of water, and each of them carries 240 tuns.

COMETS.---THEIR CHARACTER AND SOURCE.

The spectroscope shows us that comets consist of a mass of carbon dust, so diffused as to make them bulky with little weight, and this explains at once the cause of the total absence of refraction of the light freely passing between those minute dust particles.

In regard to the question "whence these masses of dust particles came," Zöllner, whose observations and calculations we mentioned in a former article on the sun, holds that the solar eruptions throw up masses, consisting chiefly of hydrogen, ejected from the sun with a velocity of 133 miles per second. He comes to the conclusion that as thrice this velocity would carry material entirely beyond the limits of solar attraction, a somewhat less velocity would throw it to distances corresponding to those of the comets. He thinks, therefore, that comets originate from the sun, and are thrown out from that body finally to return thereto, just as volcanic material is thrown out from the earth and carried through our atmosphere, eventually coming down at remote spots.

Any doubt in regard to the possibility of the existence of such enormous projectile forces is removed by the actual observations of Janssen, Lockyer, and Respighi. The latter says: "The solar surface is the seat of movements of which no terrestrial phenomenon can afford any idea; masses of matter, the volume of which is many hundred times greater than that of our earth, completely change their position and form in the space of a few minutes, showing motion of which the velocity is measured by hundreds of miles in a single second." Professor Young has observed a solar explosion of which the mean velocity, between the altitude of 100,000 and 200,000 miles above the solar surface, was 166 miles per second; as this indicates an initial velocity of 200 miles per second, it is sufficient to carry the projected matter beyond the orbit of the earth.

Schiaparelli, in the *Astronomische Nachrichten*, calls the comets "cosmical clouds." He says: "Cosmical clouds will always appear to us as comets when they pass near enough to the earth to become visible." The comparison is indeed striking; as watery clouds ascend in our atmosphere and float around the earth, so the fiery clouds from the solar surface ascend into planetary space and float around as comets. Both are raised by solar heat and are afterwards cooled.

It is possible that the hydrogen in the solar protuberances is at first so abundant that its spectrum overcomes the spectra of the other materials which it may hold, as it were, in solution; and that while being projected, it expands by its gaseous nature in the planetary space, leaving the carbon and other materials, as a mass of dust which slowly disintegrates by the disturbing influence of the solar heat, planetary attractions, and adhesion of the different particles, forming finally great numbers of small and dense masses, which will fly around the sun in the form of a belt; and when some of them at last come down upon the earth, we call them meteors. Schiaparelli further says: "Gradually the products of disintegration are distributed along the comet's orbit; and if the earth's orbit cuts this, the phenomena of shooting stars are produced."

Two interesting facts are connected with these views; one is that the position of some well determined meteor streams coincides with the orbit of a comet; the other fact is that recently chemists have extracted hydro-carbon from meteoric masses: indicating the hydrogen which the spectroscope shows to exist in excess in the solar protuberances, and the carbon which the same instrument shows to exist in excess in the comets.

A PERFECT VACUUM.

The ancient philosophers who defended the theory that "Nature abhors a vacuum" were greatly derided by their opponents; but modern research would seem to confirm their views. There is an anecdote that Galileo, who, as our readers know, lived in the seventeenth century, on being con-

sulted by some engineers of Florence who found it impossible to raise water in a pump barrel higher than thirty-four feet, told them that Nature's abhorrence of a vacuum extended only to a hight of thirty-four feet; and that beyond that hight, it had no objection to an empty space. Galileo's pupil Torricelli first demonstrated, by actual experiment, the cause of water rising in a pump barrel from which air had been exhausted, and his theory was firmly established by the experiments of Pascal. Torricelli's experiment can be readily reproduced. Take a glass tube, more than thirty inches long, filled with mercury, from which the air has been expelled. Put the open end of this tube into a cup filled with the same liquid, and the mercury in the tube will fall until it has reached a hight that can be balanced by the pressure of the atmosphere. The space in the tube above the mercury is called the "Torricellian vacuum," and is the most perfect vacuum that can be produced by mechanical means. By a perfect vacuum we mean empty space, and this space above the mercury is supposed to contain two substances: 1st. The vapor of mercury, which is there in virtue of the principle that evaporation takes place from the surface of all liquids, at all temperatures except that of absolute zero. 2nd. The subtle and elastic medium of ether, which is supposed to pervade all space. Many physicists have made experiments to determine the existence of this ether, but its effects are best observed in the motions of Encke's comet, whose periods of return to its perihelion are constantly diminishing. The undulating theory of light is also based on the existence of the ether.

It becomes interesting, then, to inquire whether a perfect vacuum can be produced in any manner. Admitting the existence of the ether, which has some tension, even though it be too small to be measured by the most delicate instrument, it will be seen that the problem cannot be solved, unless we can destroy the tension of this ether. There is a theoretical temperature, at which (if it could be produced) all vapors would lose their tension. This is the point of absolute zero, at which all heat motion ceases. This is a point which can never be reached in practice, but can readily be determined, and is marked on the thermometric scale as follows: —219·2° Réaumur's scale, —274° centigrade scale, —461·2°, Fahrenheit's scale.

Before closing, we will explain how a degree of exhaustion can be reached, which is almost perfect with the exception of the ether. In the use of an ordinary air pump, at each stroke a pump full of air is removed, and the remaining air expands and fills the whole space. Hence, with the most delicate machine, there will always be some tension in the receiver, unless other means are employed. Let the pump and receiver be filled with carbonic acid instead of ordinary air, and let this be exhausted by successive strokes of the pump until the tension is very slight. Then introduce potassa or caustic lime, which will absorb the rest of the carbonic acid, leaving a perfect vacuum, as far as can be ascertained by a measuring instrument or gage.

TIME AROUND THE WORLD.

We have received of late sundry queries from correspondents relative to the gain or loss of time in circumnavigating the globe. Those who have not found answers in the columns devoted to such purpose will receive a general response in the following rather amusing discussion recently carried on between two grave and learned French *savants* on the same rather paradoxical topic. M. Jules Verne, of the French Geographical Society, has written a book entitled a "Tour around the World in Twenty-four Hours." What the nature of the contents of the volume is, we know not; but at all events it excited M. J. Bertrand, of the Academy of Sciences, to attempt to pose M. Verne with the following conundrum: "A person, supposed to be furnished with the necessary means of transportation, leaves Paris at noon on Thursday; he travels to Brest, thence to New York, San Francisco, Jeddo, etc., returning to his starting point after twenty-four hours, that is, encircling the globe at the rate of 15° of longitude per hour. At every station, as he passes on his journey, he asks: "What time is it?" and he is invariably answered: "Noon." He then inquires "what day of the week is it?" At Brest, "Thursday" is the reply, at New York the same; but on his return, supposing he passes Paris from the east and stops at Pontoise, a town some 19 miles to the northwest of that city, he will be answered "Friday." Where does the transition happen? Or when, if our traveler is a good Catholic, should he consider Friday's abstinence from meat to begin? "It is evident," continues the questioner, "that the transition must be sudden, and may be considered to take place at sea or in a country where the names of week days are unknown; but," he continues, "suppose the parallel at which it happens should fall on a continent habited by civilized people speaking the same language, and that there should be two neighbors separated, say by a fence, on this very parallel. Then would not one say it was Thursday, at noon, while at the same moment the other would assert it to be Friday, at the like hour?"

M. Verne answers as follows: It is true that, whenever a person makes the tour of the globe to the east, he gains a day, and similarly when traveling to the west he loses a like period, that is to say, the twenty-four hours which the sun in his apparent motion occupies in describing a circle around the earth. This is so real and well recognized that the administration of the French navy gives a supplementary day's ration to vessels which, leaving Europe, double the Cape of Good Hope, while it retains on the contrary a similar provision from ships rounding the Horn. It is also true that, if a parallel existed, such as above described, across an inhabited region, there would be complete disagreement between the people adjacent thereto; but this parallel does not exist, for Nature has placed oceans and deserts in our path where transition is made and a day gained or lost unconsciously. Through an international convention, the point for making the days agree has been fixed at the meridian of Manilla. Captains of vessels, under the same rule, change the dates of their log books when they pass the 18th meridian.

Edgar A. Poe, if we are not mistaken, avails himself of this apparent puzzle, in one of his desultory sketches, to point the story of an individual whose would-be father-in-law refuses him the hand of his adored, with her concomitant of an agreeably large dowry, until that time shall happen when "two Sundays fall in a week." The luckless lover in despair goes to sea, sails round the world, and returns to renew his suit exactly one year from his departure. In the course of events a discussion takes place between himself and the stern parent relative to the present day of the week, in which he insists that it is Monday, and the old gentleman is equally positive that it is Sunday. The one produces his diary, kept since his departure; the other falls back upon the calendar. Finally it transpires that the traveler in sailing round the globe to the east has gained a day in his reckoning; hence both disputants are right, two Sundays have come together, and the happy *dénouement* follows.

THE TEXAS PACIFIC RAILROAD.

The line of the Texas and Pacific Railroad, which is one of the youngest of the great transcontinental routes now in process of construction, is, with its connections, to connect New York with San Diego, on the Pacific coast, and thence with San Francisco. In extent, the road to its terminus will be four hundred and fifty miles shorter than any line now connecting the metropolis with San Francisco, or, with its branch to the latter city, will not exceed, in the distance passed over, any of the present routes.

The surveys across the continent, which have recently been made, indicate that the region chosen is especially adapted to the construction. Among the remarkable features, it may be noted that the summits to be crossed are about thirty-two per cent less than those on existing Pacific roads, while the grades and curvature will be about sixty-two per cent less. The climate through which the line is located is so favorable that no train need be delayed by snow or similar obstructions, common upon the northern roads; and an abundance of excellent coal for fuel is accessible at numerous points. The entire rail transportation between the waters of the Pacific and New Orleans will be less than 1,800 miles, and with ports in Texas, something under 1,500 miles. Adding to these advantages the bordering Mexican States, with their great mineral wealth, together with the immense traffic of Texas, California, New Mexico, and Arizona, it certainly seems that the enterprise will prove of great value, both nationally in opening to trade an almost unrivaled section of the country, and individually in the large profit which it must yield to its projectors.

As regards the progress of the road, we have before us the report of the President, Hon. Thomas A. Scott, in which it is stated that nearly four hundred miles of the line have been graded, and the bridging so far advanced as not to retard the laying of the iron. The greater portion of the ties needed have been distributed, and the rails, etc., for three hundred miles, are being forwarded to cities along the route as rapidly as possible. The labor has been accomplished since last October in the face of serious obstacles in the way of transporting material. Work has also been begun at San Diego, and is being rapidly pushed forward. The grant of six millions of dollars of bonds, made by the State of Texas, to the road was coupled with the condition that the line west from Marshall, and west from Texarkana, should be completed to a point of junction near Fort Worth, by January 1, 1874, so that by that date quite an extensive portion of the route will be finished.

President Scott considers that, judging from past progress, the entire road will be built within a period of five years' and consequently much within the time granted for its completion.

Fishing Tackle.

We were shown a few days ago a trout fishing rod, made for a friend of ours by Mr. Thomas Tout, of Kingston, Mass., which excels in beauty anything we have seen in this line for some time.

It was made of lance wood, and provided with a number of extra tips of the same material and of bamboo. The mountings were silver plate, finely finished and of chaste pattern. The rod possesses, in an unusual degree, that peculiar elastic quality which an expert fisherman readily understands by the handling, but which it is difficult to adequately describe. It was very light, weighing only 8 ounces, as flexible as a whip thong, and strong enough to land a grampus.

A Competitive Trial of Rock Drilling Machines.

It has been announced that a trial of apparatus used in quarrying and boring rock will be held at Pittsburgh, Pa., on July 8, 9 and 10 *proximo*. To this competition, owners and patentees of drilling apparatus, whether worked by hand, compressed air or steam, drilling bits and tools, electric and other fuses, and all other appliances used in rock cutting and mining are invited to send their inventions. Steam power will be furnished gratuitously, and the trials will take place in a quarry, so that really practical results will be obtained. These experiments are likely to be of great interest to the coal mining population, to whom the necessity of practical mechanical appliances is one of great importance. Further particulars will be found in our advertising columns.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE PROPER MOTION OF PROCYON.

M. Struve, director of the Russian Central Observatory at Pulkowa, has discovered a very small star, at a distance of about two seconds from Procyon. The position which this body occupied during the observations accords perfectly with the hypothesis of Dr. Auwers that the irregular movement of Procyon is due to its movement around some smaller and hitherto unknown companion, through a period of about forty years. The mass of this new star, it is concluded, cannot be less than half that of the sun.

PROGRESS OF THE ST. GOTHARD TUNNEL.

During the month of March last, the piercing of the St. Gothard tunnel advanced to 806·4 feet. The total number of workmen employed is 813. Considerable difficulty has been experienced owing to the percolation of water through the micaceous rock. At one time, the flow averaged 75 quarts per second, greatly delaying the progress of the work.

RUSSIAN OBSERVATION OF TRANSIT OF VENUS.

The Russian government has appropriated 70,000 roubles (about $55,000) for observation of the coming transit of Venus. Twenty-four expeditions will be dispatched to various parts of the globe.

A NEW BLUE COLOR.

A new shade of blue of great beauty has been obtained by Springmühl from a secondary product derived from the manufacture of artificial alizarine. The color is consequently extracted indirectly from anthracene, produced from tar. It is stated that, under certain conditions, it is superior to the aniline blues, but at present its cost is quite high.

CASTING THE STANDARD METERS.

The International Metric Commission, which met in Paris in October last, decided that each of the States represented should be supplied with a standard meter made from iridiated platinum, and that the manufacture of all the bars should take place at the same time and from one melting of the alloy. Before proceeding with this extensive and delicate operation, the French section of the commission, to which the work is entrusted, have recently caused to be made two type meters in order to test the processes which will be hereafter employed in forming the standards. M. Deville having succeeded in obtaining iridiated platinum in a perfectly pure state, the fusion and casting of the types recently took place in his laboratory in presence of the President of the Republic and many other distinguished personages. Nineteen and four fifths lbs. of platinum were, by the action of the oxyhydrogen flame, melted in 45 minutes with 2·2 lbs. of iridium, the latter, it may be here remarked, being by far the least fusible and hardest of the metals which accompany platinum in its natural state. The ingot was cast in a mold formed from a block of carbonate of lime, the interior surface of which was brought to the state of caustic lime under the excessive temperature therein developed. By this means all risk of fissures within was avoided. The metal cooled in the mold, retaining its brilliant surface, after which the bar was suitably rolled and finished. The operation was a complete success, and will be repeated with the 440 lbs. of alloy necessary to compose all the standards. This will be a metallurgical process, says *Les Mondes*, far exceeding in magnitude anything of similar nature that has yet been attempted with these inalterable metals.

NEW HORTICULTURAL FERTILIZER.

Some time since we called attention to a new chemical fertilizer for horticultural purposes, suggested by Dr. Jeannel of Paris. *Les Mondes* of recent date, in commenting on results obtained by its use, says that it represents the fertilizing principles of at least one hundred times its weight of concentrated animal manure, and supplies to the plants nitrogen, phosphorus, potash, sulphur, and iron in a completely soluble state. The compound consists of 400 parts of nitrate of ammonia; 200 parts biphosphate of ammonia; 250 parts nitrate of potash; 50 parts muriate of ammonia; 60 parts sulphate of lime, and 40 parts sulphate of iron. These ingredients are pulverized and mixed. One dram of the powder (about a teaspoonful) is then dissolved in a quart of water and a wineglassful of the solution given two or three times a week, in accordance with the health and luxuriance of the vegetation.

The plants may be placed in any kind of earth, however poor, even pure sand, or may not be potted at all. It is stated that certain flowers, the fuchsia, for example, may be cultivated without earth by simply placing the stalk in a jar, at the bottom of which is an inch or so of water, just sufficient to cover the ends of the roots. To the fluid a proportional quantity of the fertilizer is added, as above specified, once in eight days. The foliaceous development of plants treated with the substance is said to be truly wonderful, and yet the rapid growth of the leaves does not interfere with the most luxuriant flowering. To this we may add that quite recently we have tried a compound hastily composed of the majority of the substances above detailed, merely as an experiment, on a small and sickly fuchsia. The plant was drooping and little else remained than a half dry stalk. After two applications of the fertilizer, its effect was apparent, and at the end of ten days, during which probably half a pint of solution had been supplied to the earth, new shoots had sprung out, leaves formed, and the entire plant became perfectly loaded down with buds.

T. J. A. says: The SCIENTIFIC AMERICAN is the most valuable paper within my knowledge, and I have read all the foremost papers in the land.

NEW RIFLE ATTACHMENT FOR FOWLING PIECES.

We were recently shown, at the store of Messrs. Cooper, Harris & Hodgkins, No. 177 Broadway, in this city, a very ingenious device whereby an ordinary central fire, breech loading, double barreled fowling piece can be at once transformed into a rifle. The appliance, which may be combined with either one or both barrels, is simply an extra barrel, or tube, of steel, rifled within. Exteriorly it is made to exactly fit the interior of the bore, a suitable enlargement at one extremity rendering it conformable to the cartridge chamber. It is pushed into the breech with no more trouble than an ordinary metallic cartridge, and completely lines the barrel, from the rear flush to the muzzle.

For sportsmen who desire to travel light, without the extra weight of both fowling piece and rifle, we should think this to be an excellent and convenient arrangement. Its small size enables it to be readily transported in the field, so that the hunter is provided with a piece, one barrel of which is adapted for shot and the other for ball; or if, while pursuing birds or small animals, he suddenly sights larger game, he can immediately alter his gun from a smooth bore to a single barreled rifle, or, if he has two extra tubes, to a double barreled rifle.

NEW MODE OF CHAIR CONSTRUCTION.

We have, in the past, called the attention of our readers to the defective construction of modern household chairs, which, however well seasoned the timber used in their manufacture may be, are rarely durable, or even able to withstand for a short time the ordinary wear and tear of moderate use. The inventor of the device which we illustrate herewith proposes a simple arrangement which, he claims, adds greatly to the strength of the piece of furniture through disposing the material so as to provide for opposing the strains in the most effective manner possible. The most destructive of these strains occurs when the chair is tilted back by a heavy occupant. The tendency is for the seat and back legs to close or form a more acute angle, and for the seat and fore legs to open or form a more obtuse angle, as also for the fore legs to withdraw from the seat.

These tendencies he directly opposes by introducing a brace, counterbrace, and tie; and in order that one shall assist the others, these various parts are embodied in light and handsome metallic trussings, which, at the angles, are let into and attached to the rails and legs of the chair by means of bolts or heavy screws, as shown in our illustration.

Very light castings, thus applied, securely hold the articles together, and give permanent stiffness and strength to the lightest chairs. These castings, of malleable iron, may be made plain or ornamental, japanned, silvered, or gilded, and are applicable to the cheapest as well as to the most costly chairs. Patented March 18, 1873. For further particulars address G. F. Ells, Deposit, Delaware county, N. Y.

Miller's Combination Sprinkler.

Messrs. Underhill & Miller, of No. 183 Water street, this city, manufacture an improved form of combination sprinkler, which is excellently adapted for farm uses. The implement consists of a large syringe provided with a one-sided spout full of small holes on the upper side, through which a liquid, destructive to noxious insects, can be thrown in spray on the under side of the leaves of plants. The sprinkling spout can be easily detached and straight pipes of various sizes substituted in order to fit the device for use as a syringe for cattle or ordinary medical purposes. All the appliances are packed in a neat case, and are accompanied by packages of Miller's compounds for trees and plants and also for veterinary uses. We have used the apparatus and can recommend it to those of our readers who may have gardens to cultivate and cattle to care for.

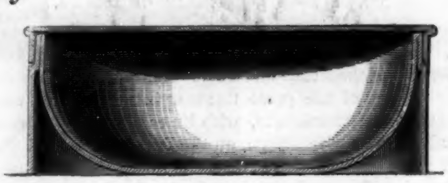
PROFESSOR CRYNI, of Brussels, and others, have found favorable results from the administration of large doses of iodide of potassium in the second stages of Bright's disease.

BLACKING BOX.

Our illustrations represent an improved form of blacking box, affording both perspective (Fig. 1) and sectional (Fig. 2) views. It will be noticed that the receptacle for the blacking is made saucer-shaped, the rounded bottom allowing all of the composition to be used The sides are vertical, extending down from the upper edge to form a support for the box and also to receive the cover which fits over the upper flanged portion, as shown.

Fig.1

Fig.2



The advantages claimed are economy in the use of blacking, none being wasted by caking in sharp corners, ready removal or affixing of the cover, and the absence of rough or sharp edges which cut the brush. Patented July 11, 1871. For further particulars address the inventor, Mr. Dennis O'Leary, Hubbard, Trumbull county, Ohio.

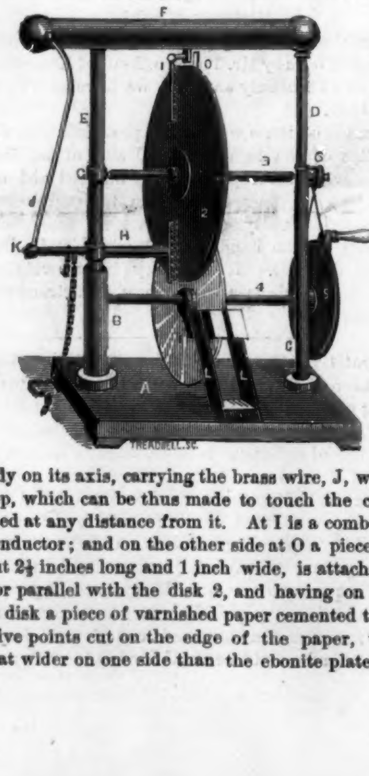
CARRE'S ELECTRICAL MACHINE.

This machine consists of an arrangement by which a current of electricity is derived from a combination similar to the electrophorus.

A is the base of wood or metal, $1\frac{1}{4}$ inches thick and 16 inches square. B and C are two round pillars of wood (or ebonite), B being 10 inches and C 17 inches long; they are both 2 inches in diameter. These pillars pass through the base, and have nuts below to fix them securely. E is a round ebonite (or glass) rod, $1\frac{1}{4}$ inches in diameter and 16 inches long + the piece of it screwed into B. The rod, D, is of glass or ebonite, 8 inches long, and the same diameter as the other, with a piece 1 inch long at the lower end fitted with cement into C, and a piece $2\frac{1}{2}$ inches long at the upper end going up into the prime conductor, F. The conductor is a cylinder of tin plate lacquered black, with two brass spherical ends fitted into it, one of which has a pipe soldered into it, up which the end of the glass rod, D, goes and fits tight. The rod, E, has a hole, tapped with a screw thread in the upper end, and a screw is put down from inside the conductor into this, and secures the conductor to the rod.

1 and 2 are disks of ebonite—1 being 12 inches and 2 being 18 inches in diameter. They are fixed to thé axes 4 and 3 respectively. 4 is turned by the pulley wheel and handle 5, and this pulley wheel drives 2 at a rate six times as fast as 4 goes round. The rate of the upper disk may be more than this, but should not be less. The lower disk is $\frac{1}{4}$ inch thick, the upper one a full $\frac{1}{16}$. The axes are of wood, with brass fittings at the ends.

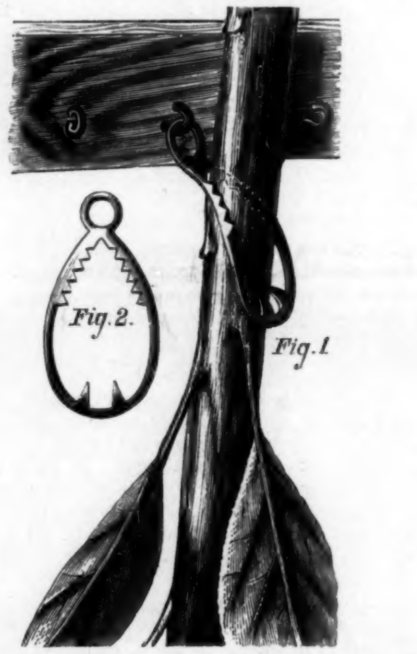
The band in the figure is represented as crossed, but it is no matter which way 2 turns. At G is a collar of brass, with a pinching screw to hold it on the rod, E, and this collar carries the pin at the end of the axle 3, on which it turns. H is a brass pipe carried by a similar collar, and carrying the comb for collecting the electricity as near as possible to the surface of 2; at the other end is a bell, K, capable of rotating stiffly on its axis, carrying the brass wire, J, with a ball at the top, which can be thus made to touch the conductor or be fixed at any distance from it. At I is a comb attached to the conductor; and on the other side at O a piece of ebonite, about $2\frac{1}{2}$ inches long and 1 inch wide, is attached to the conductor parallel with the disk 2, and having on the side next the disk a piece of varnished paper cemented to it with four or five points cut on the edge of the paper, which is somewhat wider on one side than the ebonite plate, so that these points are projecting in the direction in which the disk 2 is turning. A correspondent says that he put this apparatus to his instrument as a matter of faith: it seems to work as well without it, and he does not in the least understand what its office is. Lastly, at L L is the rubber, consisting of two cushions, which clasp the disk 1 closely, and are supported by two thin wooden springs, L L, fastened to a block of wood at the bottom, which slides on and off on a dovetail fixed to the base A. The cushions are covered with thin leather, stuffed with horsehair; and the amalgam is bisulphuret of tin, called *aurum musicum*, rubbed on the cushions. The disks overlap by 4 inches, and run as close together as possible. The disks should be carefully selected, without winding or buckles in them. When the machine is in action, the comb at H is connected with the ground by a chain, and the ball at the top of J is brought away from the conductor till the striking distance is attained. This machine gives from 3 to 5 inch sparks easily and in torrents, with a condenser showing a square foot of surface. One or two of the sparks are enough for most people. There is a necessity for occasionally washing the disks, first with fluid magnesia and then with paraffin, as the ozone appears to turn the sulphur of the ebonite into a coating of sulphuric acid, which attracts moisture. This would be avoided by glass discs, but they produce much more friction. A piece of Bristol board well dried, and when well dry well coated with shellac, might be tried for the disk 2. If glass rods are used for E and D, they should be coated with shellac, as the machine is much inclined to blow and leak everywhere.



The above, from the *English Mechanic*, will inform those of our correspondents, who have asked for descriptions of the construction of an electrical machine, how they may make a good instrument.

TOBACCO HANGER.

Green tobacco is suspended in the drying house by lashing the stalks to horizontal poles with twine, an operation requiring some skill, necessitating waste of cord, and often causing injury to the leaves. Dr. Frank C. Johnson, of Brooklyn, N. Y., in order to improve upon this system, has recently patented a simple and ingenious invention, illustrated herewith, which will doubtless find ready appreciation



among all cultivators of the nicotian weed. The butt end of each stalk is passed through an oval metal ring, Fig. 1, on the inner side of which are formed a number of notches and two spurs. By the means shown in Fig. 2, the plant is then suspended to a hook or nail, its own weight crowding it against the sharp projections, which firmly hold it. To remove the stalk when the tobacco is dry, it is only necessary to lift it and crowd it to the side of the ring opposite the two spurs, when it will readily pass out of the holder. Patented August 27, 1872.

How Deltas are Formed.

It appears from the observations of Mr. David Robertson, F. G. S., that in fresh water particles of clay were held suspended for a long time before wholly subsiding, while salt water, or a mixture of salt and fresh, became comparatively clear in the course of a few hours. The results showed that water only slightly brackish had a great power in precipitating the clay, and from this he concluded that the great bulk of the clay carried down in solution by rivers must be deposited before it could reach any great distance from the seashore. This may throw some light on the formation of deltas, and on the silting up of river courses within the influence of the tides. It may also assist in determining how far the glacial mud, for example, could be carried into the seas by tides and currents.

NEW MODE OF PREPARING ANIMAL MANURES.—Coignet purposes to treat animal refuse of all kinds with superheated steam to effect its conversion into manure without nuisance. He is convinced that this will be the best method of treating the offal of the slaughtered oxen on the La Plata.

STRAW-BURNING PORTABLE ENGINE.

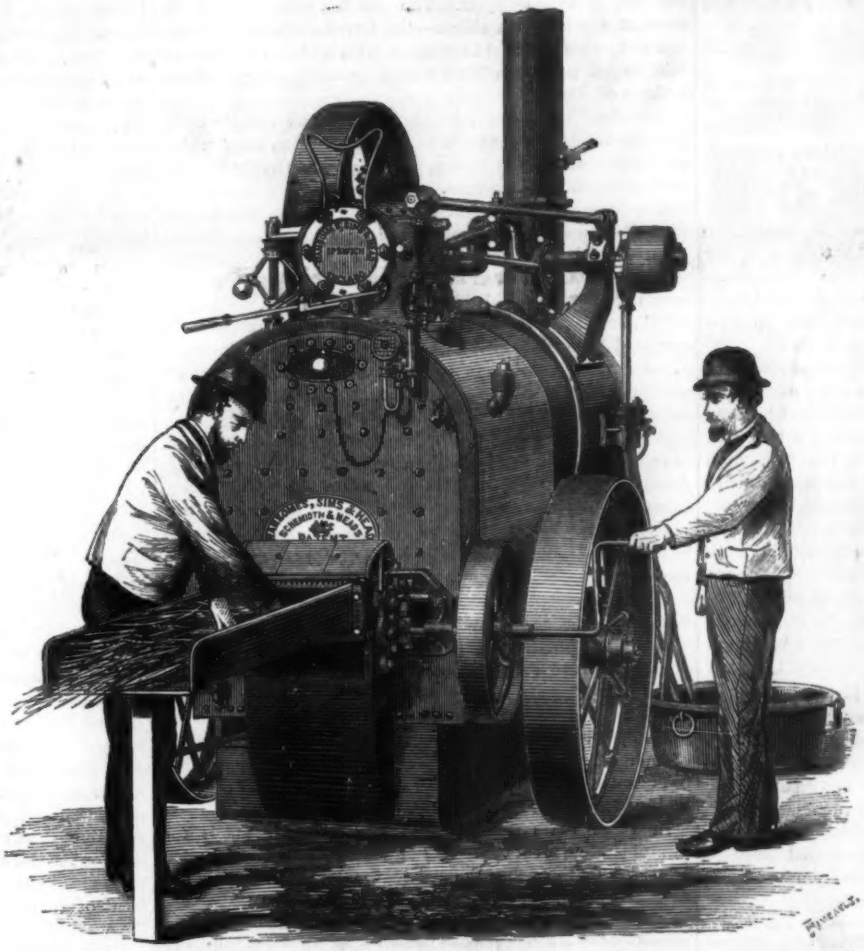
The main obstacle to the employment of steam to any great extent, in the agricultural operations carried on over the great prairies of the West, is the difficulty of obtaining fuel. Forests are scarce, and from this are made the objects of preservation rather than depletion, while the high freights, and consequent expense of coal materially diminish the economical advantages of steam. It was for this reason that corn has recently been burned as fuel, the staple, owing to the excessive transportation charges to the Eastern markets, being cheaper to use for such purposes than either coal or wood. In view of the above facts the importance of the invention represented in our engravings, for which we are indebted to *Engineering*, will be widely appreciated, more especially when we add that it furnishes a means of employing straw, corn stalks, reeds, and similar vegetable matters, which abound in enormous abundance in our Western States, as a valuable and effective fuel, capable of generating sufficient heat to keep up steam in a boiler.

The principal ideas of the device were conceived by Mr. Schemioth, a Russian engineer, who communicated his plans to Messrs. Ransomes, Sims, and Head, of Ipswich, England. This firm, adds *Engineering*, "after fifteen months of continued trial, have at last produced the most perfect engine yet invented for burning straw or other vegetable products."

In some of the early experiments much trouble was experienced in obtaining sufficient atmospheric air through the bottom of the fire box, owing to a deposit of silicious matter which covered the bars with a sort of clinker; and after trying various schemes, the following simple method was found to be the most practical: The bars are placed about 4 inches apart, and between each pair is a blunt knife projecting about 2¼ inches above them. Each knife is attached to a cross bar sliding on two guides under the grate, one end of this bar terminating in a long handle extending beyond the ash pan. When the bars require to be cleaned, the fireman moves the knives backwards and forwards, giving them, at the same time, a side action, which cuts out the clinkers, these falling into the ash pan, where they are immediately quenched by a jet of cold water from the feed pump, thus avoiding any danger from the escape of the burning ashes in cases of windy weather.

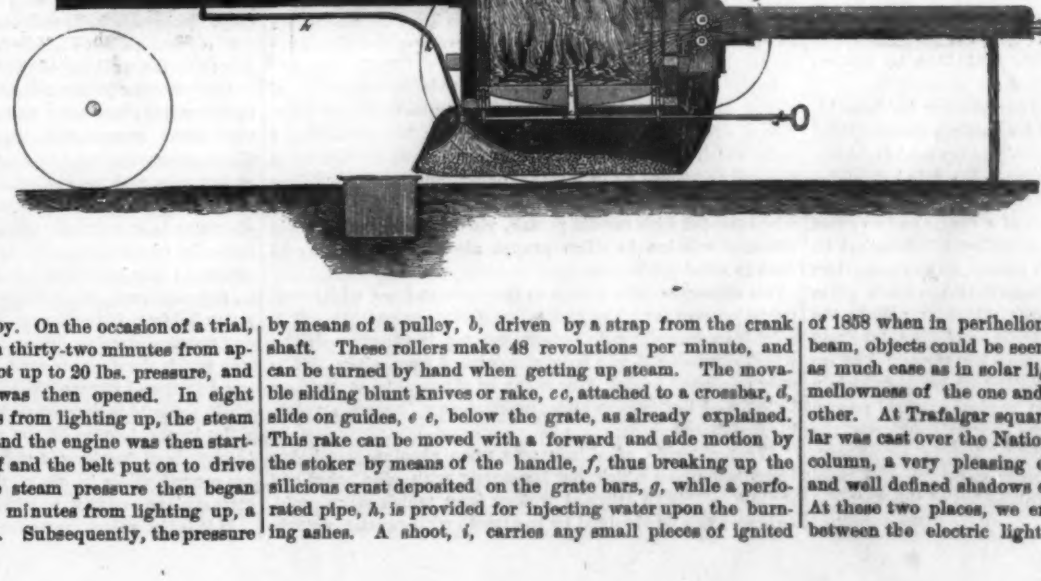
The apparatus for feeding the engine consists of rollers, which force the straw in so that each separate piece comes under the action of the flame. It is self-acting, and driven by means of a strap, and steam may be got up in the same way as with any other combustible, by attaching a handle to the feeding rollers and turning them by hand instead of by steam power. One man only is necessary to feed the straw into the engine, provided the material is brought to him and placed alongside the feeding trough. The average consumption is about four to five times the weight of coal; and according to experiments made, about ten to twelve sheaves of straw are required to thrash one hundred sheaves of wheat.

The engine represented is an ordinary 10 horse power portable, except that it is provided with a larger fire box than is used for coal burning, and that the tubes are of slightly smaller diameter than those ordinarily employed. The straw-burning apparatus is constructed precisely as shown by our engraving, and the straw is burnt in its natural condition, and not subjected to any artificial drying process. On first lighting up, the rollers have, of course, to be turned by hand to feed the straw into the fire box, but this is very light labor and can easily be performed by a boy. On the occasion of a trial, detailed in our cotemporary, in thirty-two minutes from applying a light, the steam had got up to 20 lbs. pressure, and the steam jet in the chimney was then opened. In eight minutes more, or forty minutes from lighting up, the steam pressure had reached 31 lbs., and the engine was then started, the steam jet being shut off and the belt put on to drive the straw-feeding rollers. The steam pressure then began to rise rapidly; and in fifty-one minutes from lighting up, a pressure of 60 lbs. was reached. Subsequently, the pressure was raised to 70 lbs., and a brake, applied to the fly wheel, was loaded so as to cause the engine to develope 20 effective horse power, the speed being 140 revolutions per minute. With this load steam was maintained steadily and with the utmost ease, the whole of the arrangements working admirably. The combustion of the straw was thorough and complete, only a few stray particles of unburnt material occasionally finding their way into the ash pan, while, by an occasional use of the rake or knives already mentioned, the grate bars were readily kept clear. The water jets in the ash pan also thoroughly fulfilled their purpose of preventing ignited particles from flying about—an important matter where thrashing is going on—and altogether the trial was a most satisfactory one in all respects.



STRAW-BURNING PORTABLE ENGINE.

One of the illustrations which we give represents a perspective view of one of these engines getting up steam, showing the position of one man feeding and the other turning the rollers by hand. The other engraving consists of a section of the fire box. In these views, *a a* are toothed rollers fitted with malleable teeth, and connected with the engine by means of a pulley, *b*, driven by a strap from the crank shaft. These rollers make 48 revolutions per minute, and can be turned by hand when getting up steam. The movable sliding blunt knives or rake, *c c*, attached to a crossbar, *d*, slide on guides, *e e*, below the grate, as already explained. This rake can be moved with a forward and side motion by the stoker by means of the handle, *f*, thus breaking up the silicious crust deposited on the grate bars, *g*, while a perforated pipe, *h*, is provided for injecting water upon the burning ashes. A shoot, *i*, carries any small pieces of ignited straw back into the ash pan, and *j* is a wooden trough to contain the straw which is to be fed into the furnace, and which can be removed when the engine is traveling. The whole apparatus swings on a hinge, *k*, and can be taken off in a few minutes, and the ordinary fire door substituted when coal or wood is burned.



This is without doubt one of the most important steps that has been made in the construction of portable steam engines since their introduction, as they can now be used in any country where vegetable produce can be raised, instead of, as heretofore, being practically restricted to those countries where coal or wood can be procured.

Trial of the New Electric Light Machinery at the House of Commons.

Gramme's magneto-electric machine has been now for several months before the public, and the effects obtained, says *Engineering*, have been of such a nature as to confirm our statement that, scientifically and practically, it is one of the great inventions of the age.

The essential requisite for the production of electric light is that the machine evolve a current of considerable quantity and tension, for experiment proves that the most effective arrangement for illuminating purposes is neither quantity nor tension alone, but a combination of both, which may be easily obtained by paying due attention to the gage and length of the wire, the connection of the bobbins, and the speed with which they are driven. In the present case, the velocity need not exceed a maximum of 350 revolutions per minute.

Such a moderate rate obviates the great inconveniences caused in other machines by the overheating of the armatures. This is the great drawback in Ladd's and Wilde's apparatus, which in other respects are admirable pieces of workmanship and skill. Practically this advantage appears to us to be of as much importance as the distinguishing feature of the Gramme itself, namely, the absolute continuity of the current and its uniformity of direction. This development of heat causes not only mechanical inconveniences, but also, by raising the temperature of the conductors, it increases the resistance and thus diminishes the strength of the current. Now the heat developed in the Gramme machine becomes perceptible only when the work to be done is not proportional to the current generated. But as the electro-motive force varies with the rapidity of rotation, it is evident that the latter may be regulated to suit the requirements of the case. By attending to this, little or no heat may appear in the coils, and a very large fraction of the power expended may be converted into useful work. On the night of May 25, we had the opportunity of examining the apparatus on the clock tower; the speed was only 300 revolutions per minute. The machine is in the engine room under the peers' lobby; the interpolar wires are bracketed to the walls from which they are insulated by passing through the space between V shaped pieces of ebonite. The wires are not covered, insulation from the air being deemed unnecessary. They are carried from the engine room to the lantern of the tower, a distance of 900 feet; consequently three times that of the Foreland, and the greatest distance, we believe, the terminals of an electric light generator have as yet been carried. The gage used is the 000 B. W. G., or ·425 of an inch in diameter. The intensity of the light on the 25th of May was equal to 8,000 candles. Very dark glasses were required to look at the lantern even from a considerable distance. The beam, as it shot through the air, reminded one of the lustrous silvery appearance of the tail of the comet of 1858 when in perihelion. At the place illumined by the beam, objects could be seen, and books and letters read with as much ease as in solar light, allowance being made for the mellowness of the one and the brilliant argent color of the other. At Trafalgar square, a very black shadow of the pillar was cast over the National Gallery; at the Duke of York's column, a very pleasing effect was produced by the sharp and well defined shadows cast by the trees and their foliage. At these two places, we endeavored to realize the difference between the electric light and that emitted also from the

clock tower by the 300 gas burners of Mr. Wigham, enhanced by the most elaborate optical aids; and we must say that the contrast was indeed very striking, a few minutes having elapsed before we were able to discover the path of the beam projected by the latter. In the immediate vicinity of the Houses, Mr. Wigham's light is very soft and pleasing to the eye; but at a distance, by no means considerable, it is scarcely visible. Perhaps the proximity of the electric light may contribute to diminish its splendor; if so, the results are all the more in favor of the new machine.

The carbon points are eight inches long and half an inch in thickness. They last for about four or five hours, and then require to be replaced.

Correspondence.

The New Corundum Mines of Pennsylvania.

To the Editor of the Scientific American:

In company with Professor Garth and Messrs. Willcox and Green, the undersigned made a second visit to the recently discovered corundum mine, near Unionville, Chester county, Pa. The proprietors, Messrs. Ball, Chandler & Perrey, are now engaged in mining the corundum and preparing it for the market. For the latter purpose, they have erected the appropriate machinery to reduce the corundum to powders of various degrees of fineness. In the reduced state, it has a nearly white appearance and looks exceedingly clean.

The mine in its present state exhibits a good exposure of the nearly vertical bed of corundum. A deep excavation exposes a breast of almost fourteen feet in width, disappearing east and west beneath the superincumbent gravel and clay on the sides of the pit. The crest of the bed, upon which the corundum is being removed by blasting, is about five and a half feet in thickness. It is of course impossible to estimate the extent of the bed of corundum. It probably extends along the breadth of the hill, but may reach in depth for many hundred feet. Professor Garth has recently been investigating the corundum and the associated minerals of this mine and those of North Carolina; and he will shortly present us with a highly interesting and valuable communication on the subject. JOSEPH LEIDY.

REMARKS BY THE EDITOR.—Corundum, it will be remembered, is the substance chemically known as alumina, which is an oxide of aluminum, being composed of two parts of the metal aluminum and three parts of oxygen gas. An impure variety of corundum or alumina is known as emery, while the purer varieties rank among the precious stones, known as the ruby and the sapphire. Corundum stands next to the diamond in hardness, and the prepared powders mentioned by our correspondent are extensively used in the arts for polishing and grinding purposes.

The Chlorodizing Process of Extracting Silver from Refractory Ores.

To the Editor of the Scientific American:

I forward you a specimen of refractory silver ore (from the Gilpin mine near Georgetown, Col.), containing argentiferous galena, sulphuret of silver, black sulphide of silver, green carbonate of copper, covelline, copper pyrites, marcasite and zinc blende.

Enclosed you will find a sample of amalgam obtained from the same grade of ore (mineral from the same vein.) It was worked on a large scale, one tun and a half at a time, by the chloridizing process, and afterwards amalgamated at a cost (here) not exceeding ten dollars per tun, the mineral being delivered at the reduction works.

The specimen of retorted silver is from the same amalgam, and is over 920 fine, a quality which I believe has never before been produced in the United States, especially from refractory ore, except by John N. Palmer, Jr., who, in company with your humble servant, worked the ore above referred to. The ore was chloridized to 94½ per cent.

As much has been said about the impossibility of amalgamating refractory ores of Colorado, I forward you the samples so that you may examine them and test them for the benefit of science; and, if you consider this article worthy of publicity in the columns of your illustrious paper, please insert the facts after having tested them.

Georgetown, Col. PERCIVAL STOCKMAN.

REMARKS BY THE EDITOR.—This result evinces considerable progress in American metallurgy. A low bullion of from 300 to 500 fine used to be an ordinary result. The maximum chlorination by the Stetefeldt furnace is 92½, or two per cent less than by Messrs. Palmer and Stockman.

The Retardation of the Earth's Rotation by Tides.

To the Editor of the Scientific American:

Having given John Hepburn, in your number for June 14, permission to ventilate his reasons for holding that the tidal movements cannot influence the earth's rotary motion, please allow me to show why he should change his mind straightway.

Let us suppose that, in the course of a year, the two great tide waves make twelve revolutions, in direct order, that is, from W. to E.: also, that the earth rotates, in the same time and direction, 365 times. It is evident that the earth gains upon the tides over 350 revolutions; which is plainly the same thing, in all its mechanical effects, as if the tides stood still and the earth rotated between them 350 times. And we have here an exact picture of a rotating wheel, to which a brake is applied and held in position by some external power.

I suppose it is well known that the slow retardation of the earth's diurnal motion is an established fact in astronomy. If J. H. will station himself at the opposite celestial pole, perhaps he can favor us with an explanation of this fact.

ORTHODOX.

ALCOHOL FROM FLINT AND QUARTZ.

ABSTRACT OF A RECENT LECTURE BEFORE THE ROYAL INSTITUTION BY PROFESSOR EMERSON REYNOLDS, M. D.

Carbon has hitherto been considered the sole alcohol forming element; but the chief constituent of flint and quartz, namely, silicon, must now be admitted to share in this power, and likewise in the ability to form other remarkable compounds. I have here a quantity of finely divided flint mixed with some powdered fluor spar; when I pour oil of vitriol on the mixture, and apply heat, a colorless gas is obtained, which, when passed into water, produces a highly acid and gelatinous liquid. The gas is a compound of the element fluorine with silicon—the tetrafluoride of silicon—and this, when brought in contact with water, produces an acid called hydrofluosilicic and a quantity of gelatinous hydrate of silica.

The clear acid liquid, when treated with caustic soda, yields this white salt, the fluosilicate of sodium, from which we directly obtain the silicon, as you see, by simply heating with some metallic sodium. In this case the sodium replaces the silicon, the latter separating, as you observe, in the tube as a dark brown substance.

Unlike carbon, silicon in any of its forms easily combines directly with chlorine, producing the liquid chloride which I have in this tube. This is a very volatile body, boiling at 50° C., and is half as heavy again as water. It can also be prepared from silica by heating to full redness the finely divided oxide and carbon in a current of chlorine. In composition, this chloride is the silicon representative of tetrachloride of carbon.

We can easily obtain the impure gas by Wöhler's method, in treating a compound of silicon and magnesium with hydrochloric acid. We thus obtain a colorless, spontaneously inflammable gas, which burns with a bright light on contact with the air. In its pure condition, siliciuretted hydrogen is not spontaneously combustible at ordinary pressure, but in a slightly rarefied atmosphere it easily inflames.

The siliciuretted hydrogen is evidently the chemical analogue of marsh gas, the tetrahydride of carbon.

It is usual to regard marsh gas as the typical carbon compound from which some alcoholic series may be supposed to spring, and, in fact, all the alcohols belonging to the group of which the well known wood spirit and spirit of wine are the chief members are commonly regarded as derivatives of marsh gas, in which a part of or all the hydrogen has been replaced by one or more compound radicals, such as hydroxyl, methyl, ethyl, propyl, etc.

In these cases the carbon of the marsh gas is the grouping element of the compound, or that constituent which serves to bind together the different materials of which the molecular edifice is constructed. In the same way, the silicon in siliciuretted hydrogen may be shown to be the nucleus round which can be grouped hydroxyl, methyl, etc., so as to form the alcohols I shall presently have to refer to.

In 1857 Buff and Wöhler obtained a volatile fuming liquid on heating crystalline silicon nearly to redness in a current of dry hydrochloric acid gas. The precise nature of this liquid was unknown until 1871, when Friedel and Crafts published the results of their admirable researches upon Buff and Wöhler's liquid, and showed that it was a mixture of chloride of silicon with a new body, which proved to be the strict chemical analogue of our well known chloroform, silicon replacing carbon.

$SiHCl^3$ Chloroform. $CHCl^3$.

This body is a colorless, mobile, and very volatile liquid boiling at 35° C. I have a quantity of it in this tube. One of its most remarkable properties is that of exploding with great facility when its vapor is mixed with air. If I pass the vapor of silicon chloroform into water nearly ice cold, a white solid body is obtained without any evolution of hydrogen, and an acid liquid produced. The white solid then collected, washed, and dried at a low temperature, forms a white inflammable powder, which was first described by Buff and Wöhler. Friedel and Ladenburg have shown that this remarkable body is the anhydride of the silico-formic acid. According to the results of my own investigations, the acid liquid to which I referred just now contains, in addition to hydrochloric acid, the true silico-formic acid—a body possessing nearly as energetic reducing properties as the corresponding acid derived from wood spirit.

Starting from silicon chloroform, then, we have been led, by analogical reasoning in the first instance, to infer the existence of a simple silicon alcohol precisely corresponding to wood spirit. On testing this induction by experiment, we have obtained answers which are, so far as they go, altogether favorable to the view just stated.

In the course of their elaborate and able investigation of silicon compounds, Friedel and Crafts discovered that chloride of silicon easily acts upon common alcohol, producing a body which Friedel and Ladenburg have recently shown to be easily attacked by a mixture of sodium with a curious substance contained in this tube—zinc ethyl. The product, when treated with caustic potash, yields a body which bears the same relation to silico propyl alcohol that formic acid does to wood spirit.

This silico-propionic acid is in this tube, and is a white combustible powder, like the silico formic-anhydride. It is soluble in warm caustic potash, but not in caustic soda; by which character it can be distinguished from silica. It is only necessary to state that it can be obtained in aqueous solution, and in the pure state, by Professor Graham's valuable dialytic process.

When chloride of silicon acts upon absolute alcohol a body is obtained which, on treatment with zinc ethyl and sodium, yields an ethereal product from which silico-propionic acid can be obtained by treatment with caustic potash. If, however, instead of using the caustic alkali we continue the action of zinc ethyl and sodium, decompose the products with water in sealed tubes, and distil, a liquid is obtained which contains one of the "alcohols from flint" we are in search of. In this tube I have a small quantity of the alcohol. It is the silico-heptyl alcohol, precisely corresponding to a simple carbon alcohol recently discovered by Nahapetian, both being tertiary alcohols. We owe to Ladenburg the discovery of this lowest known term of alcohols containing silicon. As you can observe, it is a colorless liquid, not unlike the ordinary alcohol of wine. It is insoluble in water, but easily dissolved by spirit and ether. Chemically it acts just like any of the other alcohols, producing ethers, and dissolving the alkali metals to form sodium or potassium alcoholates. When common spirit burns, you are aware that its flame is nearly colorless, but I shall now burn some of our alcohol from flint, and you will find, particularly when we feed the flame with oxygen, that a bright light is emitted.

Clearly defined though this alcohol is, it does not stand alone, for at least one other compound of the same order is known. It was suggested in 1870, by Friedel and Crafts, that silicon ethide—a body easily prepared by the action of chloride of silicon on zinc ethide—might be regarded as the hydride of silico-nonyl, and should stand in the same relation to an alcohol that marsh gas does to common wood spirit, or ethyl hydride to ordinary alcohol. This happy idea, when put to the test of experiment, was fully justified by the result, for on treating silicon ethide in essentially the same manner that we should adopt in preparing wood spirit from marsh gas, a colorless liquid, lighter than, and insoluble in, water is obtained. The boiling point of this body is 190° C. It yields an ether with acetic acid, dissolves sodium, forming an alcoholate, and, in fact, conforms to the general habits of the alcohols of the series to which common spirit belongs. It is precisely similar to the nonyl alcohol prepared by Pelouze and Cahours from American petroleum.

Ladenburgh has very recently advanced even beyond the point we have now reached, and has shown that the chloride of silicon can be made to yield two ethers, which correspond, as I may suggest, to silico-nonyl diatomic and triatomic alcohols.

In all the preceding compounds but one atom of silicon is present, and though the silicon in these cases occupies the chief position as the grouping element, we should much like to see silicon uniting with silicon and forming a more condensed compound with hydrogen. Happily, however, very important evidence, even upon this point, is forthcoming, for Friedel and Ladenburg have discovered corresponding hexa-chloride, iodide, and bromide of silicon, and treatment of the hexa-iodide with zinc ethyl enables us to obtain the ethide.

It is not improbable that, in the last named compound, we have the starting point of a new series of still more complex bodies, analogous to derivatives of olefiant gas rather than to those of marsh gas.

A rich and beautiful field for chemical research appears to lie before us in tracing out the analogies between the compounds of carbon and silicon, and recognizing the chemical representatives of many of the most complex "organic compounds" in the native silicates which form so large a part of the crust of this earth.

The practical value of scientific research is rarely apparent at first. Who could have suspected that the benzole discovered by the venerable philosopher whose name is so inseparably connected with this institution, would have proved, in the able hands of Perkin and of Hoffman, the chief source of many of the exquisite dyes now largely manufactured in this country? Yet in this, as in a hundred of other instances, the small and apparently useless scientific seedling has gradually expanded into the strong tree, yielding its rich store of useful fruit. Let us hope that a similar future awaits some of the alcohols from flint which have been referred to, and that, in pursuing our studies of the silicon analogues of the more complex carbon compounds, we may be led to appreciate more fully than we have hitherto done the admirable economy and harmony of Nature.

Booming.

"Booming" is the name of an operation with which probably our Eastern readers are not generally familiar. Hence, we extract, from the columns of the *Mining Review*, an explanation of the process as practised by the miners of Colorado. Booms are built and run for two purposes: the discovery of veins hidden under the deep slopes of the mountain sides and the working of gold placers on a large scale.

The reservoir is first constructed at the head of the ground to be worked; into this water is conducted, from the most convenient source still higher up, by flumes or ditches. These reservoirs vary in size from a small pond to an acre or two lake, and the ditches are often eight, ten, and twelve miles long. When the basin is full, and a continuous head of water is in running operation, gates are opened, letting loose the whole volume of the liquid, which tears down the mountain side in a huge volume, sweeping everything before it, carrying tuns of boulders, gravel, and dirt down to the gulch below. If auriferous ground is to be worked, a long and massive wooden flume is built at the foot of the hill, into which the *débris* is carried, with all the force of the falling waters and the sand and rocks washed along in its course while the gold is deposited by its own gravity, behind the riffles in the bottom of the race. These flumes are often thousands of feet long, and as rocks of all sizes and weights are carried along in them, they must be built with great strength and solidity, to withstand the immense wear.

If it is the object, however, merely to uncover the veins of

which no trace can be found by scientific prospecting, no flume is built in the gulch, but the water allowed to take its own course. On its way down the mountain side, it cuts out a huge trough from 20 to 50 feet wide; and if the operation is prosecuted with vigor and plenty of cash, the bed rock is reached and swept clean from top to bottom, and a huge delta of mud, rocks and clay left in the valley below. The water is then shut off, and the owners of the boom examine the clean rock and claim all the veins exposed.

SANITARY NOTES---SEWERAGE AND SEWAGE.

It is no exaggeration to say that the problem of the conversion of the excremental waste of towns and people and the refuse of factories into useful materials is now engaging as much of the attention of intelligent minds throughout the world as any social question. The English press is burdened with publications on this general subject. Chemists, farmers, political economists, engineers, and physicians are all at work upon it. Costly experiments are being constantly made to test the worth of the various proposed plans. Stock companies are formed, whose business is first to make money for themselves at any rate, and, secondly, to benefit the rest of the world by their ventures. From all this excitement we ought to derive much useful information, and, from the experience gained in foreign countries, gather knowledge which may be turned to practical account in solving a problem which, in the natural course of the country's growth, must eventually be forced upon us. In briefly considering the subject, we draw for our facts upon the recent report of the State Board of Health of Massachusetts, and premise by explaining what is meant by the words

"SEWER," "SEWERAGE," AND "SEWAGE."

The last two are often confounded; but they signify quite different things. A *sewer* is an underground passage for the conveyance of water, filth and fluid, or half fluid, refuse emptied into it from the smaller drains from houses, factories, and streets. *Sewerage* is a system of sewers or subterranean conduits, and the word refers only to these works or constructions, while *sewage* is the material which is or may be conveyed in sewers. Public health requires that the foul fluids, half solids and solids, resulting from human excretion from the waste of food, from washing, and from the refuse of various manufactures, shall be either speedily removed from among the living, or that the character of these materials shall be so changed that they will not undergo decay. We have therefore to consider, first, the primary means of getting rid of this noxious waste; and second, how to utilize its valuable properties after we have provided for its removal. For merely disposing of human refuse, there are two principal systems to which we shall allude. The first is the

DRY EARTH SYSTEM.

Abundant experience has shown, and in these columns we have repeatedly explained the fact, that earth (not gravel or sand), when carefully dried so that it has lost all coherence or stickiness, and has become a powder, possesses the power of absorbing and reducing to an inodorous form the excretions of the human body, provided it be applied in quantities so as to completely cover and absorb all fluidity thereof. The mass may be removed at convenient times and seasons and used immediately as a fertilizer for land, or it may be dried and employed many times without giving off any offensive odor. Similarly, dry ash of hard coal or anthracite may be used instead of earth.

In densely populated cities and towns there are difficulties inherent in this system which will render its general use impracticable. If it is intended to absorb both the solid and fluid excretions of the human body (and the latter contain far more fertilizing material than the former), four or five pounds of dry earth must be supplied daily for each individual. Thus, in a city of 100,000 people, 250 tuns must be brought in every day from the surrounding country, and a somewhat larger amount carried out. And this must be divided among some 10,000 different houses, each of which must be carefully provided for. At the present high price of labor, it is evident that, financially, such operations are out of the question. The case, however, is altogether different with country houses with land from which the earth may be taken and to which it may be profitably returned. Here the wells will be protected from fouling, the stench of unsightly outhouses prevented, and the annoyance occasioned by frost obviated. In prisons and large establishments where labor is cheap, and possibly in boarding schools, the system may also be advantageously applied. Without proceeding further into a subject which we have already fully treated both in theory and practically, by illustrating and describing the many excellent inventions which have been introduced for its application, we proceed to the second systematic method of disposing of human excretion known as the

WATER CARRIAGE SYSTEM.

This is by the underground drains and sewers which all compactly built towns are obliged to have in order to get rid of the surface water falling as rain, and also for drainage of the soil. With these sewers, by means of water closets, baths, etc., the interior of dwellings are brought into close connection. Consequently, whatever gases are contained in these underground passages seek to diffuse themselves through the buildings. These gases are dangerous to health, though what the specially noxious element in them is, no one can define.

The sensible properties of sewer air are quite remarkable. It is by no means fœtid, as many people suppose, neither is it pungent or ammoniacal. It is rather negative in character, faint in odor, mawkish, smelling, perhaps, more like soap than any other familiar substance. This air frequently escapes into houses, diffusing a virulent poison and carrying with it the seeds of disease; it is subject to pressure from sudden influx of water in rainstorms, and in sea board towns by the action of the tide. It is also caused to rise from the difference of temperature of the house and sewer; and unless the joinings of the soil pipes are perfect, and have not become leaky through contraction and expansion, it is forced out and quickly spreads through the dwelling. Defective traps and similar imperfections in the plumbing also form free vents. For these reasons, it is best to give the whole drainage plan of the house the freest possible communication with the outer air at a point so elevated that the sewer gases cannot fail to be diffused and got rid of. This can readily be done, while building, by carrying the soil pipe, made of iron, at full size, through the roof, and leaving it open like a chimney. By this arrangement all stagnation is prevented; the contents of the house drains are constantly exposed to the oxidizing and purifying influence of currents of air; when rain conductors are filled with water, there is still free escape for the sewer gases; and the water traps throughout the house are relieved from pressure both of the pent up sewer air on the one side, and of suction or atmospheric pressure on the other. In the houses already built, a lead pipe may be readily carried from the highest point of the soil pipe directly through the roof; but the larger the pipe and the straighter its course, the better.

THE TREATMENT AND VALUE OF SEWAGE.

Experience having shown that the best method of getting rid of excretal and other matters is by the water carriage system, the question arises what shall be done with the sewage. As we have above intimated, many and various plans have been proposed, from which the conclusion may be justly reached that the purification of sewage is a possibility to an extent that it may be discharged into running streams without vitiating the water to any extent other than to unfit it for drinking purposes. The writer of the report before us qualifies this view, however, with the opinion that no process has yet been proposed which, unless in exceptional cases, renders the purification an operation of real profit, although it may be conducted so that there shall be some pecuniary return. Before entering upon the description of some of the principal plans, it may not be amiss to add a word as to the value of this waste material. The value of the annual voidings of an average individual is, by competent authority, estimated at from $1.61 to $2.01. The value assigned to "average" sewage by the English Rivers Pollution Commission is per 100 tuns $4.10, or about 4 cents per tun. Then sewage of London, for example, is estimated to amount to 260,000,000 tuns annually, which, considered as worth only two cents a tun, aggregates $5,000,000; that of New York would be worth close upon $2,000,000.

THE LIME PROCESS

consists in mixing the sewage with a certain proportion of milk or cream of lime, agitating the mixture violently and then allowing it to subside. There settles from the mixture a copious precipitate of a highly putrescible mud, while the liquid flows off in a tolerably clear condition. As far as purifying the sewage is concerned, the process is a failure. The suspended matter; removed are also found to contain only about one tenth of the valuable constituents; so that, as a manure, the product is of no special merit. The drying of the mud is a very offensive operation. Practised in England, the manure only brought 1s. per tun, and sold sparingly. This sum was about one third its cost of production.

BLYTH'S PROCESS

consists in attempts to recover the ammonia from the sewage. Superphosphate of lime and a salt of magnesia are added, under the supposition that an insoluble phosphate of magnesia and ammonia will be thrown down. Unfortunately, however, this compound is only insoluble in the presence of an excess of ammonia; and, moreover, analyses show that a third part of the phosphoric acid added is left in the solution, proving absolute loss. The English Sewage Commission consider this the worst and most costly plan yet proposed.

HOLDEN'S PROCESS

is a patented operation, and consists in mixing the sewage with sulphate of iron, lime, and coal dust. It not only fails to remove the putrescible organic matters in solution, but actually augments their quantity. An analysis of the air dried mud showed the presence of only ·3 per cent phosphoric acid, ·004 per cent ammonia, and 0·555 per cent of organic nitrogen; so that, as a manure, it is practically worthless.

THE A B C PROCESS

we fully described in a recent issue of our journal. It derives its name from its essential ingredients, alum, blood, clay, and charcoal, which are mixed with water and run into the sewage in a continuous stream. The good results obtained by its use we have already fully detailed.

THE PHOSPHATE PROCESS

is founded on the fact that certain mineral phosphates, especially those containing alumina, when in a hydrated or freshly precipitated state, eagerly combine with the organic matter contained in the sewage, it being sufficient merely to agitate them in the most fœtid sewage to deprive it of all its odor and color, even if tinctorial substances of great intensity be present in the solution at the same time; while the phosphate of magnesia combines with the ammonia contained in the sewage, and precipitates it also in the state of the double phosphate of ammonia and magnesia. The process delays putrefaction in the effluent water, but the amount of ammonia carried down by the precipitate is found to be practically nothing. The manure is of course valuable on account of the proportion of the phosphate used in its manufacture; but it is hardly probable that it could be made the source of extended profit.

MORFIT'S PROCESS

replaces the natural phosphate of alumina by a new artificial material, which is in fact a waste product at present, being the "mother water" as eliminated by the processes of the inventor for the precipitation of pure phosphates of lime from hydrochloric solutions of mineral phosphates of lime. In his recent work on chemical fertilizers, Dr. Morfit says that the precipitate forms a superior special manure for clay soils, and devotes an entire chapter to detailed descriptions of methods for its utilization.

The Largest Railroad Shops in the World.

Located in Cheshire, one of the midland counties of England, and situated on the London and North Western Railway, some five sixths of the distance between the metropolis and Liverpool, is Crewe, a small and insignificant town by itself, but a city of no mean importance when considered in connection with the vast works which it contains. The establishment which supports, and, in fact, forms the town, the population and extent of which is about half that of Worcester, Mass., was originally laid down by George and Robert Stephenson, and is known as the Crewe Works, or, as it would be termed in this country, the shops, of the London and North Western Railway. Here no less than six thousand hands are employed, building or rebuilding the two thousand locomotives used upon this longest of English railways, or working upon the two hundred and twenty engines which, it is calculated, are always at the works for repairs.

A correspondent of the Boston *Journal of Commerce* has recently visited this great factory, and, from the graphic letter which he writes, we extract the following interesting particulars: He says that a most extraordinary variety of especial tools is employed, among others several testing machines for trying the strength of materials used. Samples of every variety of material, and especially the boiler iron and steel, are submitted to these machines. For the proving of the iron for axles, there was a little machine in which a sample was submitted to a rapid series of torsional strains till it broke, the number of these, registered by a counter, being an index of the character of the iron. As an illustration of the attention to the smaller details of expense, a cleaning machine was running in the brass shops, consisting of an endless belt studded with small magnets, which, passing through the mass of filings in an inclined trough, thoroughly cleaned them of all fragments of iron. A large number of milling machines were in use for smaller work, especially such as finishing the heads of nuts and bolts, and many small bench shaping and slotting machines were running as many as 160 strokes per minute; engaged in a similar work, by using cheap labor (boys of twelve), the latter could compete with the former. Among other larger machines was one for grinding large plane surfaces, such as base and frame plates and side plates of tenders, instead of planing them, the work moving in a trough containing water, and the whole arrangement being quite on the plan of a Daniells planer. Much smaller flat work was finished by grinding in machines arranged to produce a level surface by self-operating attachments.

Perhaps the most remarkable thing in this part of the works was the huge lathe room, more than two hundred feet long, and filled with a double row of driving wheel lathes. Many of these were of eight feet swing, and of the heaviest description, carrying four cutters at once. A remarkable machine, near these, was a milling tool for milling out the inside cranks. All the engines have inside connections, the axles are forged solid and milled, instead of being turned out. The cutter of this machine was four feet in diameter and about five inches fall. There were here many other peculiar tools, such as a machine milling two key ways, exactly at right angles, at once, in the two ends of a locomotive axle. Also a wheel rimming machine, and another for slotting out in a proper curved form, the inside rims of locomotive wheels between the spokes.

A new process for making steel tires is here employed. The steel is cast in the form of truncated cones, the smaller end to form the outside of the tire. While still hot it is introduced to the horizontal steam hammers. These consist of a couple of enormous masses of iron, each running on a little track, and moved back and forth, by means of piston and rod, by a large steam cylinder behind each, the steam valves of each of which cylinders are operated by a common lever. By passing through two sets of these hammers, the steel is thoroughly worked up, and leaves them in the form of a thick disk. Carried from these, it passes to an upright hammer, with a sharp conical end to the striking part. This soon forces a hole through the disk, which, being turned round and round, and over and over, becomes a thick ring. Again heated, it goes to another hammer. This hammer has a very heavy anvil, with a peculiar slope to one side, from which projects a stiff horn. Upon this horn the ring is hung. The face of the striking part is formed to the slope of the rim and flange of the wheel, and as the workmen manipulate the wheel under its blows, slipping one portion after another of the rim up to receive the stroke, the whole tire gradually expands to the requisite diameter, and is ready to be turned on the inside and driven on to its wheel.

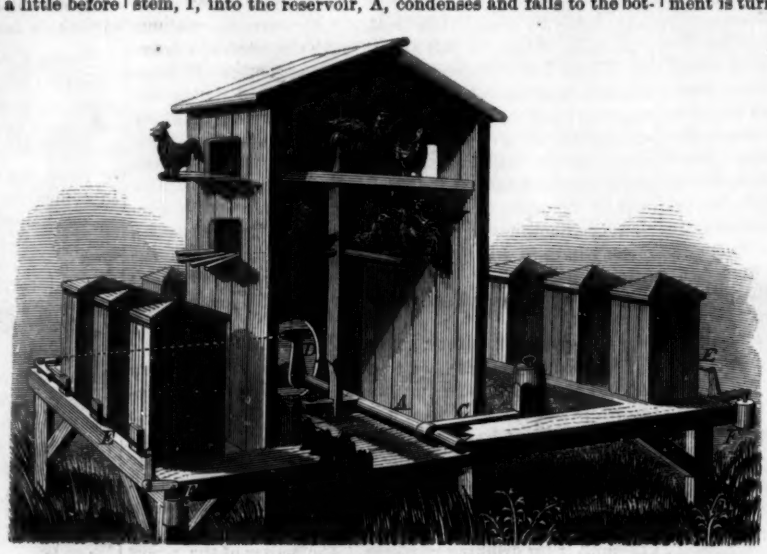
These details were noticed in but a small portion of the vast factory, but serve to give an idea of the completeness and magnitude of its construction and fittings.

BEE PROTECTOR.

The ingenious inventor of this device, before putting his ideas into practical shape, doubtless became convinced of the immutable truth of these facts: First, the busy bee improves only "shining hours," and gathers honey from opening flowers only by day; second, the bee moth has a predilection for stealing honey under cover of the night; and, third, chickens retire to their roosts at twilight, and are aroused by the "shrill clarions" of the masculine portion of their population at an excessively early matutinal hour. To utilize these propositions to compass the desired end, was the problem: how it has been solved, we proceed to show. The bees are expected to enter their domiciles a little before dark. After they are all in, the period for the roosting of the chickens arrives. The latter, alighting on their perches, operate machinery which closes the hive gates and shuts the bees in. The bee moth, on attempting his burglarious operation, finds himself barred out, and as the mechanism of the device is beyond his comprehension, it is to be inferred that he retires in disgust. Meanwhile the chickens repose until the early village cock proclaims the morn, when they abandon their perches to resume their geological investigations into the surface of the adjacent soil, and thus return the bees, their honey all safe, to the airs of heaven and flowers of earth. For the benefit of all who may be interested in this strikingly novel application of the force of gravity through the medium of chickens, we append the following detailed description of the mechanism, a patent on which was granted June 28, 1870, to Jeremiah Cory, of Holden, Mo.:

A is a horizontal rock shaft, secured in suitable bearings and provided with three arms, B, C, and D. The arm, B, within the house supports a vertical sliding post which is held in guides, and bears the perches. The arm, C, carries an adjustable weight, sufficiently heavy to overbalance the post and keep it elevated when the roosts are unoccupied. The upright arm, D, is connected as shown by the dotted line with the rods, E E, attached to the gates of the hives. Suitable weights, F, are arranged in connection with the rods, E, so as to hold the gates open.

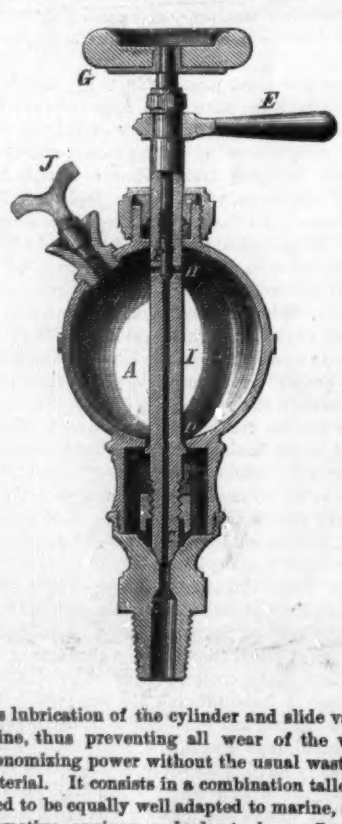
As the fowls mount upon the roost their weight depresses the post, and it, in turn, presses down the arm, B, and thereby rocks shaft, B, and its arm, D. The latter, operating the rods, E, closes all the hives. As soon as the roost is vacated, the weights bring the parts to their original positions. The advantages claimed are the regularity and certainty with which the hives will be closed and opened, and the fact that any number of hives may be connected with the device and simultaneously operated.



BEE PROTECTOR.

BREWSTER'S PATENT COMBINATION TALLOW CUP.

The object of the invention herewith illustrated is a steady



or continuous lubrication of the cylinder and slide valves of a steam engine, thus preventing all wear of the working parts and economizing power without the usual waste of lubricating material. It consists in a combination tallow cup, and is claimed to be equally well adapted to marine, stationary, and locomotive engines, and also to have afforded results in every way satisfactory, during the period in which it has been in use.

In the sectional view annexed, A is the main reservoir and B an auxiliary reservoir or charger, containing one tenth the quantity of material that the former receptacle is capable of holding. C is the main valve connecting directly with the cylinder, and D is a secondary valve closing communication with the reservoirs, A and B. These valves are operated by the handle, E. F is the feeding valve, closed when the main valve, C, is opened and actuated by the wheel, G, serving to regulate the openings, H, in the stem, I. J is the inlet funnel with valve-seated plug. The main valve, C, being closed by means of the handle, E, the plug, J, is unscrewed, and the reservoir, A, is filled with tallow to the openings, H, when the plug is replaced and the valve, F, is closed. By opening the valve, C, and closing D, the tallow in the charger, B, is allowed to pass into the cylinder, when the valves are brought back into position. Nothing further is required until the supply of tallow thus afforded is exhausted, when the same operation is repeated and the contents of the charger again allowed to escape.

To render the action of the apparatus continuous, the valve, F, is opened, when the steam, passing up through the stem, I, into the reservoir, A, condenses and falls to the bottom, raising the tallow to a level with the openings, H, from which it is sucked into the cylinder by every stroke of the piston as long as the supply of tallow remains. The reservoir is left filled with distilled water, which is let through the cylinder after stopping the engine, by removing the plug, J, and opening valves C and D. In case of any foreign substance entering the reservoir, it may be blown out while the engine is in motion by allowing the steam to rush through the plug funnel.

Among the other advantages claimed may be noted strength and cleanliness, together with beauty and simplicity of construction; it is also stated that the device is steam-tight, precluding leakage, and thus dispenses with the usual means employed to absorb the waste. It may be used as an injector at stated intervals or, by arranging the valves as above described, as a self feeder, as desired. The cup requires filling but once a day, feeds regularly, has no cocks or similar mechanism to get out of order, and is economical in its expenditure of lubricant.

The manufacturers state that it has elicited favorable testimonials from many leading engineers and master mechanics, and that its efficiency has been, in every respect, demonstrated. For further particulars address Messrs. Davis & DuBois, southwest corner Leopard and Otter streets, Philadelphia, Pa.

SOLDERING TOOL.

Mr. John C. Tauber, of Ridgeville, Ind., proposes to do away with the present rather inconvenient method of handling a stick of solder and the heated iron, by the use of the device illustrated herewith, for which he has recently ob-

tained a patent. It consists in a metallic vessel, in the form of an inverted cone having a minute aperture at the bottom. It is provided with a flanged rim and socket to receive a handle; and around its lower part is placed an annular bowl or trough. The conical vessel is filled with solder and flux, and the trough, with cotton cloth or wick saturated with kerosine. The latter, being ignited, melts the solder, which, flowing from the hole, can be distributed uniformly upon the work, in greater or less quantities, as may be desired.

BOYNTON'S REVOLVING EVAPORATOR.

The invention represented in the accompanying engraving is a portable revolving evaporator, by means of which it is claimed that fruit, vegetables, meat, fish, and similar perishable substances can be dried, each forming an excellent preserve which, while compact in bulk, retains all the value of the fresh product and can be kept and transported in any climate.

The material to be treated is spread upon the shelves of netted wire shown in the foreground of the illustration. A number of these when filled are placed upon the projecting rails, A, which line the sides of the eight compartments into which the rotary portion, B, of the apparatus is divided. Ho air passes through these chambers entering from the pipes C and D, in the manner hereafter to be described.

The hollow fixed base, E, and also the similar upper portion, F, are, by radiating partitions, divided into inclosed sectors to correspond and coincide with the compartments in the rotating part above and below. All of these partitions, with the exception of those which form, as it were, the prolongation of the walls of one chamber, are provided with apertures, as shown in section at G. The solid partitions just alluded to are securely packed with felt, so that when, by the rotation of the revolving portion, B, any one compartment is turned so that its walls correspond with them, such compartment is completely cut off from all communication with the rest of the device, and hence from any supply of heated air. The object of this is to enable each chamber to be filled in succession without allowing of the escape of the heat during the operation. From this it will be observed that, of the eight compartments, one is always ready for filling, and consequently the evaporating process is restricted to the remaining seven.

Let it be supposed that a chamber has received its supply when in the position, H, and that the machine has been revolved to the right, and the compartment opened as shown. The heated air then enters from below by the pipe, C, passes in the direction of the arrow up through the material on the shelves, thence through the orifice, G, down through the next chamber, thence under the right hand wall of the latter through the perforated partition, up again through the following compartment, and finally makes its exit through the conduit, I. In the remaining four compartments the heated air proceeds down from the pipe, D, through the first division, up through the second, and so on through all the chambers, at last escaping through the chimney, J.

When the material is over the pipe, C, it is acted upon by air heated to 220°; when under the pipe, D, the temperature is 180°; and in the last compartment from which it is finally withdrawn, the heat is 120°. The windows shown in the covers of the chambers afford admission to the shelves for examination; and at any time the rotary portion can be set in motion, carrying any desired compartment to the filling door.

It is hardly necessary to point out the advantages of this device for preparing vegetables and articles of similar nature for transportation or for naval and military purposes. The inventor states that, during the past year, apples, peaches, pears, strawberries, raspberries, grapes, potatoes, corn, and, in fact, almost every variety of fruit and vegetable, have been successfully treated, producing preserves equal to the best canned articles. For fruit growers, who during the coming season may suffer through overstocked markets, an excellent means of utilizing their produce, which might otherwise prove a total loss, is here afforded. The apparatus can be seen in operation and in all its various sizes at the factory of the Vineland Dehydrating Company, Vineland, N. J., or fur-

ther particulars may be obtained from the manufacturers, Messrs. C. A. Boynton & Co., at same address. Patented April 23, 1872.

PUTTING SCREWS IN PLASTER WALLS.—It often becomes desirable to insert screws in plaster walls, without attaching them to any woodwork; but when we turn them in, the plaster gives way and our effort is vain. And yet a screw may be inserted in plaster, so as to hold light pictures, etc., very firmly. The best plan is to enlarge the hole to about twice the diameter of the screw, fill it with plaster of Paris, such as is used for fastening the tops of lamps, etc., and bed the screw in the soft plaster. When the plaster has set, the screw will be held very strongly.

Robert Marsden Latham, Secretary of the Inventors' Institute of London, and editor of the *Scientific and Literary Review*, died recently at Hampstead, England. *æt.* 38.

PARLOR AQUARIUM AND FOUNTAIN.

That there are no ornaments so beautiful as those formed by the hand of Nature, is a fact which is becoming generally recognized in the decoration of our dwellings. Rustic baskets, filled with gracefully trailing plants, vases of growing flowers, clinging vines allowed to run in unkempt profusion over windows and doorways, are now among the most admired embellishments even of the stateliest saloon or drawing room. Not only is growing vegetable life in its ever changing form thus employed in the beautification of modern homes, but, beside, animal and insect existence is called in to aid in the general adornment. A foreign cotemporary recently published an engraving of an insectarium, consisting of a Wardian case of glass, inclosing a number of growing plants, among the verdure of which were represented gorgeously hued butterflies, which, placed in the receptacle, were kept alive and nourished by the growing vegetation.

Our engraving illustrates a very tasteful parlor aquarium, made of cast iron and bronzed. The design is taken from the catalogue of the Jordan L. Mott Iron Works, of 90 Beekman street, in this city, from which work we recently made other selections of ornamental objects in metal. The hight of the stand is 57 inches, and its diameter 34 inches. Above is an octangular glass-sided vessel for the reception of the aquarium, in the middle of which is arranged a miniature fountain, and around the corners are placed vases for living plants.

The constant inflow from the fountain will keep the water always fresh and pure, though, even if the latter be not always in operation, the sanitary condition of the finny inhabitants can be maintained by a suitable selection of aquatic plants, placed in the bottom of the vessel. To prepare an aquarium of this kind, about an inch of clean sand should first be put in, and above that a light layer of gravel; then a few stones, bits of coral, shells, or clean cinders, may be built up in miniature grottoes or other pleasing forms, which will serve as shelters for the fish and add to the beauty of the ornament. Fresh water plants, suitable for planting in the bottom, may readily be obtained from any country brook. Eel grass, water weed, arrow head, frog's bit, duck weed, are all well adapted for the purpose. After setting out water is poured in, and the aquarium left for a week for the plants to vegetate. To absorb the fungous and mucous growths, fresh water snails are added, and afterwards the fishes are put in by degrees, care being taken to maintain the due balance of animal and vegetable life. A day's ramble, near a brook, will be sufficient to obtain a multitude of both animals and plants. Newts, tadpoles, sticklebacks, small sun fish, water beetles, minnows, one or two frogs, and may be a turtle, will thrive in a receptacle of this kind, and form an endless fund of amusement and instruction to lovers of natural history. The temperature of the aquarium should not rise above 70° Fah., nor fall below 50°. In hot summer days a screen should be used to cut off the sun light.

PARLOR AQUARIUM AND FOUNTAIN.

A Wonderful Model.

An elaborate model of a harbor, ordered by the Senate of Hamburgh to be constructed for the Vienna exhibition, has been completed in due course. The model is 17 feet by 6 feet in dimensions, and it exhibits the ships moored to the wharves, and the laborers employed in their different occupations. On the side of the dock is a railway with a freight train to receive goods from the ships. The vessels are of all sizes, from the huge steamer down to the smallest yawl. The whole represents, with pleasing accuracy, the busy life of a sea port.

Dyeing Aniline Green on Wool.

This dye, unlike the majority of aniline colors, has but a feeble affinity for wool. When this fiber is dyed in a green bath without previous preparation, but a very slight amount of the color is fixed. Some manufacturers have proposed to employ for this color the alkaline process, which gives such excellent results for blues, but it is with greens less certainly successful. The author's process is to prepare the wool in a bath containing a solution of hyposulphite of soda mixed with an acid or an acid salt. The sulphur suspended in the water becomes fixed in the wool, and enables it to attract the aniline green. It is advisable to add to the mordanting bath a small quantity of alum, or of a salt of zinc, the presence of which prevents the "tendering" of the wool. It is singular to see the action which the sulphur of the hyposulphites exerts upon this fiber. It becomes soft, loses its elasticity, and contracts considerably. This depends evidently on the penetration, into the capillary tubes of the wool, of that soft and viscid sulphur which is liberated from the hyposulphites. The singular property which sulphur in this state possesses of acting as a mordant for aniline green is not common to sulphur in all its modifications. Thus the solution of flowers of sulphur in the sulphide of carbon leaves wool completely incapable of attracting the dye. The same rule holds good, though to a less extent, with the polysulphides, which in all probability generally contain traces of hyposulphite. The mordant for aniline green is the insoluble electro-positive sulphur, as proved by the following experiment: When a sample of wool mordanted with hyposulphite is exhausted with sulphide of carbon, it loses nothing of its power of attracting and fixing aniline green; while another portion of wool saturated with the bisulphide of carbon which has served to extract the former, and which has been subsequently concentrated by distillation, takes up the color no better than does unprepared wool. If the operation is carefully conducted, taking suitable proportions of hyposulphite, and of alum, or zinc salt and acid, success is certain, and the wool is uninjured. It is scarcely needful to add that the wool must be previously cleansed from grease, and freed from all metallic contaminations, by passing it through very weak hydrochloric acid. If this is neglected the shade may be saddened by the formation of metallic sulphides upon the fiber. The actual dyeing is performed in a solution of the green in hot water, raising the temperature to close upon 100° C. If yellowish greens are desired it is necessary to add to the bath some picric acid, and a salt capable of raising this coloring matter, which will only dye in presence of an acid. As, on the other part, the green does not dye in presence of acids, a difficulty presents itself. This is overcome by the use of the acetate of zinc. This salt attracts the picric acid without injuring the green dyeing. If it appears that the green does not "work on" sufficiently, a little acetate of soda may be added. With the aid of these two salts the dyer can produce blue or yellow shades of green at his pleasure, and can make use of his bath for an indefinite length of time. This procedure applies equally well to mixed goods of wool and cotton. After the wool is mordanted as above, the pieces are washed in sumach for an hour or more. The dyeing is then conducted in the ordinary manner, beginning at a low temperature. Or the wool may be dyed first, and the goods may then be sumached, and the cotton dyed in a cold color bath.—*Chemical News.*

Metal Casting under Compression.

By Smith & Locke, of Boston, Mass.—The patterns are first brushed over with a mixture of olive oil and paraffin, after which they are coated with a slip composed of clay and fine sand. They are then placed in a flask which is filled in with a mixture of terra cotta (the old molds ground to powder) and clay. The flask is then placed under a powerful press, and submitted to a pressure of 400 lbs. per square inch, the mold thereby becoming condensed. From the press the molds are taken to a furnace, where they are hardened, and when ready they are placed in a casting chamber, to the number of ten or twelve at one time. The chamber is then tightly fastened, and the molten metal is forced into it, becoming distributed among the molds, and entering into the most delicate tracery of the patterns. The metal is injected through a cylinder attached to one end of the casting chamber, in which a piston is fitted, the cylinder being lined at each operation with a non-conducting substance, which prevents refractory metal from becoming chilled or adhering to the cylinder, and at the same time serves as a packing for the cylinder. The end of the cylinder next the mold chamber is fitted with a clay heading, to which is a gate stopped by a movable plug, and opening into the chamber. The molten metal having been run into the cylinder the piston is screwed up, slowly at first and afterwards quickly, when the plug is forced forward into the chamber, the metal following it, and running into the molds under considerable pressure, which is maintained until such time as the metal has set.

The above description is from *Engineering.* Mr. Smith is now in England engaged in the development of the improvement. The process has been in operation at Somerville, near Boston, since the 1st of May, 1869, where Mr. Smith has produced round as well as flat castings, such as ornamental columns. He has also cast monumental tablets 7 feet 6 inches high by 3 feet 6 inches wide, and one quarter inch thick, notably one to the memory of 400 soldiers, whose names were all cast on it. The process is both ingenious and successful, and is capable of a wide range of application in the arts and manufactures.

Paper in the Boston Fire.

Curious results followed some of the experiments made upon charred papers and documents, and the examination of books in safes which proved worthless in the great fire. It was found that what paper makers call poor paper, paper considerably "clayed," stood the test best. Parchment paper, used for bonds and legal documents, shriveled up exceedingly, and the print blistered so that it could be read when writing was illegible. So it was with the engraved work on notes. The gilding, on the account books burned and charred, showed out as bright and clear as when the books were new, which brings up the question if to introduce gilt-edged account books would not be well, on the ground that the gilt would stay the passage of fire to the pages within. Books crammed into a safe, so that it was difficult to get them out, suffered considerably less than those that were set in loosely, and in some cases came out from safes, in which every thing else was worthless, so far preserved that the figures on their pages could be deciphered. With charred papers, which could not be made transparent by any light whatever used, it was found, after the employment of vitriol, oxalic acid, chalk, glycerin, and other things, that any thing that moistened them to a certain stage—to which it was delicate work to get and not to pass—made the lines, words, and figures legible through a magnifying glass. It has been the almost universal experience that lead pencil marks show out all right where ink marks cannot be distinguished. The success of the use of photography has already been noted.—*Boston Advertiser.*

Recent American and Foreign Patents.

Improved Rotary Steam Engine.

William Cram, New York city.—This invention has for its object to furnish an improved rotary steam engine, which shall be so constructed as to relieve the shaft from all side pressure, and thus diminish the friction and the consequent wear. The cylinder is made elliptical in form, and to its ends are secured the heads in the ordinary manner. To the shaft within the cylinder is secured a cylindrical drum of such a size as to revolve in the said cylinder, a space being left upon the opposite sides of the drum for the steam. In the opposite sides of the drum are formed deep longitudinal grooves to receive the valves, upon the inner part of the end edges of which are formed pivots, which enter elliptical guide grooves formed in the inner surfaces of the heads, which are so formed as to hold the outer edges of the pistons out close against the inner surface of the cylinder. Two inlet ports are used, formed in the opposite sides of the cylinder and provided with slide valves. Said valves may move together, being connected by a yoke with which is connected one end of a lever, which is pivoted to a bracket attached to the cylinder head. The inner end of the lever projects into such a position as to rest upon a cam wheel attached to the shaft against which it is held by a spring. By this construction the steam will be received upon the opposite sides of the cylinder, so as to balance the engine and prevent side pressure.

Improved Doll Joint.

Joel A. H. Ellis, Springfield, Vt., assignor to the Coöperative Manufacturing Company, of same place.—This invention relates to the manufacture of dolls, and to the class of dolls which are usually made of wood, with joints for the legs and arms; and it consists in the manner of forming the joints and securing the requisite friction thereto. A slot and tenon are fastened together by the pivot pin. The tenon is divided by a saw kerf. The double tenon is designed to fit the slot a little full, and be sprung together slightly, when the tenon enters the slot, thus producing the requisite friction, and preventing any binding or looseness by the shrinking and swelling of the wood at any time. The shoulder piece is cut or slit at right angles, and fitted into a round socket having a groove to receive a pin, so that the arm will be securely held, while it will freely revolve. The socket is a little smaller at the back end, so that the shoulder piece is compressed, as represented, which secures at this point the required degree of friction. The arm is attached to the shoulder piece in the manner already described.

Improved Mail Bag.

Thomas J. Hardaway, Macon, Ga.—This invention is an improvement in the class of mail bags provided at the mouth with hinged bars or plates adapted to be locked together. Four bars are hinged together so as to form a rectangular and nearly square opening, and a locking piece is attached to one of the bars near the joint. The said pieces may be conveniently used as a handle for opening and closing the bag. When adjusted for locking it covers the contiguous and middle joint of the hinged bars, and thus imparts a strength and rigidity highly necessary to security of the contents of the bag. The piece is also adapted by its position to receive a label relating to contents, destination, etc., of the bag.

Improved Detachable Boot and Shoe Tip.

Michael R. Hanley, Providence, R. I.—The object of this invention is to so construct a metallic tip that it can be applied not only to shoes or boots in process of manufacture, but to those already completed or in use; and it consists in a tip having lips or teeth turned inward from its lower edge, and hook pins at each end.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District of New York.

REFRIGERATOR PATENT.—GEO. C. ROBERTS *vs.* WM. F. RYER.

BLATCHFORD, *Judge:*

This suit is brought on reissued letters patent, granted April 21, 1857, to D. W. C. Sanford, for an "improvement in refrigerators," the original patent having been granted to Sanford, as inventor, November 13, 1855, and the patent, as reissued, having been extended October 20, 1869, for seven years from the 13th of November, 1869.*

It is apparent, from the language of the specification of the original patent, that Sanford, when he applied for his original patent, believed that he was the first inventor of any arrangement in a refrigerator whereby there was effected a complete and continual rotation, purification, desiccation, and refrigeration of the whole of the contained air of a closed refrigerator. He, therefore, claimed, in that specification, the use, in a closed refrigerator, of an endless passage, furnished with walls, shelves, and ice receptacle, so placed and constructed as to compel the perpetual rotation or circulation, throughout the entire apartment or apartments, of the whole of the air contained therein, with the provision described for the discharge of the water of the melting ice, the whole being constructed as set forth.*

The defendant has a refrigerating room which he uses in his business as a butcher, and which is alleged to infringe the plaintiff's patent. The room is eight feet three inches long, six feet two inches wide, and six feet high. The ice box, at one side and in one corner, elevated, is five feet ten and a half inches long, on the long side of the room, three feet six and a half inches high, and two feet six and a half inches wide. On the two sides of this ice box which are toward the room, there is a space between the top of each of such sides and the ceiling of the room, of eight inches in hight and the length of such two sides, for the ingress of the air of the room into the ice box. A door from without opens into the ice box, by which to put ice in. Another door opens into the room from without. The ice in the ice box rests on a wooden rack on its bottom, which affords a free passage for air. Below the rack is a cold air chamber, the roof of which is the bottom of the rack, and the bottom of which is formed by two inclines, which slope downward and toward each other, and toward a center line midway of the width of the ice box, so as to leave a central opening, five feet eight inches long and two and a quarter inches wide, through which the cold air finds its way downward. The water from the melted ice falls on these inclines, and runs down them and through this central opening, where it is caught by a trough five feet ten inches long and six and a half inches wide, and set three and a half inches below such central opening. This trough is one foot eight inches above the floor of the room. There are no shelves below the central opening, but there is a rack on the floor, on which meat is placed. The water from the trough is conducted, by a pipe, out of the room. The room has been used in this way for more than nine years.

There can be no doubt, that the defendant's refrigerating room contains, in combination, the three elements which are found in combination, as before explained, in the first claim of the plaintiff's patent, and that it also contains, in combination, the three elements which are found in combination, as before explained, in the second claim of the plaintiff's patent. The heat given out by articles placed in the room warms the air, which then ascends, and passes over the tops of the sides of the ice box, and thus around the partition, and into contact with the ice, and is thus cooled, and dried, and purified, and descends through the open bottom of the ice box, and then through the central opening, and, descending further, according to the law governing the action of cooler air, displaces the warmer air, and pushes such warmer air before it, and upward, around the partition, and so a rotation or circulation of the contained air in the closed room is established, which goes on so long as any part of the contained air is warmer than any other part of it. The cooled air can fall directly down upon such articles as are placed under the central opening, without being interfered with by, and without interfering with, the disposition of the water from the melted ice, and such water is carried off and not allowed to drip into the room. The modes of operation of the combinations found in the defendant's room, are the same as the modes of operation of the like combinations found in the claims of the plaintiff's patent.

The defense principally relied on in this case is that, as to both of the combinations in the claims of the plaintiff's patent, he was anticipated by Azel S. Lyman, in inventions and structures previously made by Lyman, and that the defendant, in using a refrigerating room constructed and operating as above described, has done no more than he was fully instructed to do by such structures of Lyman.

The earliest date sought to be assigned to Sanford's invention is the summer of 1855.*

It is in evidence that Lyman, on the 20th of August, 1852, filed, in the Patent Office, a caveat for "improvements in railroad freight cars, for transporting fresh meats, and other articles, which require a very low temperature and pure air." Such caveat contains a description, and drawings referred to therein. The object of the arrangement is stated, in the caveat, to be to transport dressed meats. The walls, sides, and the top of the car are made double, and filled in with a bad conducting material, the car is closed, and the air in it is reduced in temperature by passing it, in rotation and circulation, through ice, or other cooling material, contained in a box in the car, or through tubes immersed therein. A fan driven by a cord from the axle of the car drives the air down through the cooler. After the air leaves the bottom of the cooler, it passes through a box containing disinfecting material. The air is stated in the caveat, to be preserved cool, pure, and dry by being passed frequently through the cooler and the disinfecting material, so as to keep the meats from putrefying, the moisture from the meats being deposited on the cold surface, and floating down, and being caught in a pan below the bottom of the cooler, whence it is carried off, by a tube, to the outside of the car. The caveat states that Lyman proposes to claim the providing for a constant circulation of air from the car, through the cooler, and through the disinfecting box, back into the car, by means of a fan, or some other similar mechanical arrangement; the drying of the air, by the precipitation and condensation of the water held by it in solution, by passing it through the cooler; the cooling of the air through the same process; and the construction of a cooling house, or refrigerator, in the manner above described, except that there would be other arrangements for driving the fan.

Between the date of this caveat and the year 1855, Lyman constructed, and put into successful operation, refrigerating cars and stationary refrigerators, embodying the principle set forth in such caveat, and constructed substantially on the plan therein stated, the cars being arranged with fans, to assist in the circulation of air, and the stationary refrigerators having no fans, but depending for such circulation on the law governing the movements of cooler and warmer airs, free to communicate with each other through an ice box open above and below. All these structures embodied the combinations and modes of operation before stated as found, in common, in the defendant's refrigerating room and in the plaintiff's structure.*

In April and May, 1854, Lyman caused to be constructed for one Tilton, a closed refrigerator, which was put in use by him in Franklin market, New York, during the summer of 1854, and was used by Tilton there for several years afterward. It embodied the same principles of construction and mode of operation as the Syracuse refrigerator. It had a descending conduit five or six inches wide and about three and a half feet long, and the lower end of which was about sixteen inches above the floor. It was used to preserve poultry, which was placed on three shelves. One of the shelves extended under the conduit. This refrigerator stood in the open market for several years after the summer of 1854. Lyman personally showed it to a great many persons, and explained its internal arrangements, and its principle and mode of operation.

In the summer of 1854, Lyman caused to be built nine closed refrigerators, for domestic use, which were like the Syracuse refrigerator in construction and mode of operation, except that they had no shelf below the cold air opening, but had a space or chamber there for articles to be refrigerated. These refrigerators were built at Mount Vernon, Westchester county, N. Y. Lyman used one of them in his family, for a dozen years or more from and after July, 1854. Some of the others were sent to New York and disposed of to various persons, and some were used in Mount Vernon.

Between 1852 and 1855 at least a dozen closed refrigerators, of like construction, were made at the Novelty Iron Works, in the city of New York, according to plans furnished by Lyman. In some of them the conduit extended down only one and one half inch below the cold air chamber under the ice grate, and in others it extended down to within twelve or sixteen inches of the floor of the refrigerator. These refrigerators were delivered to various parties for whom they were made. Of the above number, eight or ten were constructed at such works during the year 1854, and one of those, made there by one Hadden, for his own use, is still in existence, and has been put in evidence and produced for the inspection of the Court. This refrigerator was used by Hadden in his family for four or five years. It was and is, in construction, like the Syracuse refrigerator before described, except that it has no shelf below the cold air opening. In using it, however, Hadden placed on the floor, in and under the descending current of cold air, articles which he desired to keep the coldest.*

On the 21st of September, 1854, Lyman filed, in the Patent Office, an application for a patent, for an "improved mode of cooling, drying, and disinfecting air for ventilators and refrigerators."*

The drawings represent a refrigerator constructed substantially like the Syracuse refrigerator, and the Hadden refrigerator before mentioned.*

There is nothing in the patent of 1856, to Lyman, that is not found fully developed in his application of September, 1854. In view of that application, the patent to Sanford, of November, 1855, ought not to have been granted. Lyman's application contained everything claimed by Sanford in his patent.* The evidence shows that Lyman was the first inventor, as between him and Sanford, of what is claimed in Lyman's application of 1854, and of what is claimed in Sanford's patent of 1855, and of what is claimed in Lyman's patent of 1856.

So, too, everything that is claimed in the claims of Sanford's reissue of 1857, as those claims have been heretofore explained, is found in Lyman's application of 1854.*

The conclusion at which I have arrived, after a careful consideration of all the evidence and of the argument of counsel, is that the Sanford reissue is void for want of novelty.

As to the questions made respecting the want of notice, in the answer, as to some matters put in evidence, I think, that, in any view, the case is a proper one to allow the amendments to the answer, which were moved for at the hearing, on notice, *nunc pro tunc*, as of the time the answer was filed.

The bill is dismissed, with costs.

Barrett & Redfield and *Thomas A. Jenckes* for complainant.
F. A. Betts, J. Gutman, Jr., and *J. N. Piper* for defendant.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From May 16 to May 29, 1873, inclusive.

AIR MOTOR.—H. Bushnell *et al.*, New Haven, Conn.
ANCHOR.—C. A. Chamberlin, Pittsburgh, Pa.
BALE FASTENING.—E. J. Beard, St. Louis, Mo.
BANDSAW MACHINE.—D. B. Whitney, Winchendon, Mass.
BOOTS, ETC.—T. Tucker, Oakland, Cal.
CARRIAGE WHEEL.—N. G. Olč (of Fort Wayne, Ind.), London, Eng.
CLOTHES WRINGER.—C. E. Haynes, Boston, Mass.
ENGINE, ETC.—R. Eickemeyer, Yonkers, N. Y.
GENERATING STEAM.—J. H. Mills, Boston, Mass.
HARVESTER.—J. F. Gordon, Rochester, N. Y.
HOSE PIPE.—T. A. Dodge, Cambridge, Mass.
LIFE RAFT.—S. W. Torrey (of New York city), London, Eng.
MAKING GAS, ETC.—W. H. Spencer, New York city.
OIL BURNING STOVE.—L. E. Truesdell, Warren, Mass.
PRESERVING MEAT, ETC.—G. W. Scollay (of St. Louis, Mo.), New York city.
PURIFYING GAS, ETC.—E. Kavanagh, Peabody, Mass.
RAILWAY BARS, ETC.—J. Henderson, New York city.
SEWING MACHINE.—W. P. Brock, Philadelphia, Pa.
SPEED INDICATOR.—J. W. Osborne, Washington, D. C.
STUFFING BOX PACKING.—J. Glanding *et al.*, Philadelphia, Pa.
UNITING METAL BANDS, ETC.—C. G. Johnsen, New Orleans, La.
VAPOR OF CARBON.—W. Wells, Salem, Mass.
VEHICLE WHEEL.—A. L. Blackman, Cross Plains, Tenn.

INDEX.

ILLUSTRATIONS.

MISCELLANY.

Figures preceded by a *star* (*) refer to illustrated articles.

ANSWERS TO CORRESPONDENTS

V. V. will probably find the directions for silvering glass on p. 280, vol. 24 answer his purpose.—W. D. B.'s query about making soap with bicarbonate of soda is answered by anticipation on p. 289, vol. 28.

J. W. L. asks how to separate the constituent parts of sawdust or wood so as to get the pure cellulin. Answer: "It is scarcely possible," says Professor W. A. Miller, "to obtain cellulin free from ligneous tissue by artificial means, since the incrusting woody matter, when once deposited within its meshes, is retained with great obstinacy; but it is presented in a pure condition in finely carded cotton, in linen, and in the finest kinds of filtering paper; to these sources the chemist usually has recourse when he desires to examine the properties of cellulin. Cellulin or cellulose is dissolved by a solution of oxide of copper in ammonia, from which it is reprecipitated by acids."

R. J. asks: What is best to mix with fire clay for lining a furnace that is partly burnt out, and to stand the fire? 2. What is the best way to take soft solder out of zinc? Answers: 1. In making fire brick, the refractory fire clay is mixed with old firebrick pulverized or with sharp, clean sand and gravel. Such brick will stand an intense heat without fusing. 2. Soft solder melts at a lower temperature than zinc, so that you may be able to remove part of the solder by carefully heating it to a temperature of about 600° Fahr. If you wish to use the sulphate of zinc (white vitriol) for any purpose, or are able to dispose of it, you can dissolve the zinc in dilute sulphuric acid, which only slightly attacks the solder. Hydrochloric or muriatic acid also dissolves zinc, forming chloride of zinc, which has the property of rendering paper hard and waterproof. Nitric acid will dissolve both lead and zinc and leave the tin as a white powder.

W. McN. asks: What set, and what difference of set, if any, should there be between saws cutting pine and those cutting spruce logs? Answer: About one thirty-second of an inch on a side is sufficient for ordinary timber. Generally the same set would be required for both kinds of timber. Some kinds of pine will cut very clean and require but little set in the saw to clear; other pine timber has a very tough fiber. In such, more set would be required. Spruce varies in the same manner in different localities; practical experience is the best guide.—J. E. E.

B. G. asks how to prepare caustic lye from soda ash. Answer: Caustic soda lye for soap making can be prepared from soda ash by the use of quick lime. The soda ash is first dissolved in hot water and to the boiling solution is gradually added thin slaked lime in small quantities, and the boiling continued until a drop of the clear liquid gives no effervescence with a drop of acid. The lime takes the carbonic acid from the soda ash and is itself converted into an insoluble carbonate of lime, which settles to the bottom, so that the clear solution of caustic soda lye can be easily decanted after allowing the solution to stand until cool. The boiling should take place in an iron vessel; for a very pure quality of caustic alkalies silver vessels are employed, as the alkalies attack both glass and porcelain perceptibly when hot and strong.

A. R. asks: 1. What is the Newtonian theory of astronomy? 2. What is the cause of the diurnal motion of the earth on its axis? 3. What is the cause of the annual motion of the earth round the sun? 4. What is gravitation? Answer: 1. That there is a mutual attraction existing between all bodies of the universe, that it is directly proportional to the masses of the bodies, and inversely proportional to the squares of the distances between them; and that the planets were originally impelled by some force, which would cause them to move off in a straight line, unless acted upon by other forces. 2. The original impelling force. 3. The original impelling force, and the attraction of the earth by the sun. 4. We cannot tell. It is something by virtue of which all bodies attract each other, in accordance with the law enunciated above.

W. D. D. asks whether the principle, for multiplying power, of a screw acting upon a lever is in use, and if it is, in what machine? Answer: The principle of multiplying power by means of a screw operating on a lever is very old.

C. D. R. & Co. say: We have a return tubular boiler 18 feet long, with 40 two and a half inch tubes; and would like to know what size and hight of stack we should have made to insure a good natural draft. Answer: The data sent are rather insufficient. Probably a round stack, 15 inches in diameter and 50 feet high, would answer.

A. 33 asks: What are the dimensions and best form of a steam engine of about ½ a horse power? It should be made portable, and so as to connect the smoke stack with a common chimney. The need of such an engine has long been felt in the dairy regions, for churning, etc. Answer: The boiler should have about 12 square feet of efficient heating surface. The cylinder, with a diameter of 2 inches, should have a piston speed of 75 feet per minute. You will find dimensions and descriptions of small boilers in communications from other correspondents.

A. D. says: In Worcester's "Dictionary" (illustrated edition), there is a picture of a windlass of peculiar form, called a "Chinese crane." Will you give me your opinion whether there is any mechanical advantage in it over a common windlass? A friend of mine, who goes into the mathematics of the question, thinks that he proves that there is none. My faith in the cleverness of the Celestials makes me doubt his conclusions. Will you tell us which is right, he or I? Answer: It has a mechanical advantage over the common windlass, because the ratio of power to weight can be increased to almost any desired extent, without great complication of parts or excessive dimensions of wheel.

C. N. D. says that L. L. can repair his mirror by taking a piece of old mirror and apply a drop of quicksilver to it. He can so lift from it a scale that will effectually patch the damaged mirror, the spot of glass having been previously well cleaned.

D. R. W. asks: Will a cup made of plaster of Paris answer as the inner cylinder of a Daniell's sulphate of copper battery, instead of an earthenware one? Answer; Yes, but it will be difficult to cast it free from blow holes. No. 1 baked porous cups for Daniell's battery are only $2.25 per dozen.

W. H. I. says: I have a small cylinder boiler 2½ feet long x 10 inches diameter, made from ⅜ inch iron, with cast iron heads. What pressure ought it to bear and what power should it develope with an engine 1½ inches diameter x 3 inches stroke? Answer: The boiler could safely sustain a pressure of more than 200 lbs. per square inch. At 100 lbs. pressure and a speed of 150 revolutions per minute, the engine would develop about ⅛ of a horse power.

C. D. says: I have a well 30 feet from my stable; it is 12 feet deep. By means of a ¾ inch lead pipe, the siphon, the water is conducted to a tub in the stable. I do not let the water run full stream, but through a pipe stem. Every 3 or 4 days, I have to take out the plug containing the pipe stem to let out the air, or the water would stop running. Can you tell me the cause of this? Answer: The air in the water generally collects at the highest point of a siphon which is used continually, as the pressure is least there. There is no way of preventing this, and every few days the air must be drawn off. By placing an air vessel at the highest point of the siphon, it will work much longer before requiring to be freed from air. Siphons are sometimes fitted with small pumps at the highest point, by means of which the air can be drawn off whenever necessary.

E. G. L. says: What is the meaning of "gresse"? Is it a composition or a separate metal? 2. In tinning small malleable castings, I cannot get a smooth bright surface. How can I prevent the scum and impurities in the tin from adhering to the casting, and how can I obtain a bright finish? Answers: 1. We do not remember ever to have seen the word about which our correspondent desires information. 2. The following method is commonly employed to tin iron, and generally with good results: Clean the casting with nitric acid, afterwards washing it with water. Dip it first into muriate of zinc, and then into the bath of tin.

E. A. F. T. asks how to make a small portable boat, light enough to be carried on horseback or in a small buggy? Answer: Try a boat made of canvas, stretched on a frame, which can be folded up and is light and portable. Such a boat was used by our soldiers in the late war.

T. J. says: In a train of wheels, 3 drivers and 3 driven, the drivers are proportionally 20, 40, and 60. The first driven is the crank of a 5 horse power engine, 10 inches long; the next is a gear, 20, and the next a 30, which gives out all the power. What power is acting at the pitch line of each wheel? The engineer says it is as follows: 5 h. p. $\times 20$ (double of crank) $\div 20$ (1st driver) $= 5$ h. p. on crank and 5 h. p. on 1st driver. 5 h. p. $\times 20 \times 20 \div 20 \times 40 = 2{\cdot}5$ h. p. on 2nd driven and 2nd driver, etc. 5 h. p. $\times 20 \times 20 \times 30 \div 20 \times 40 \times 60 = 1{\cdot}25$ h. p. on pitch line of last driver 60, and last driven, 30. I think there is 5 horse power acting at the pitch line of all of them. He also says if the crank could not bear a strain of more than 5 horse power, the last driver, 60, and last driven, 30, could not bear a strain of more than 1·25 horse power, without breaking, providing the crank and wheels were proportioned by a good engineer. Please let me know if this is calculated right; and, if not, give me a simple rule for doing it. Should not the pitch of the wheels in each pair be altered? If 5 horse power would break the crank, how much would break each wheel separately? Answer: The results obtained by the engineer are correct, if the diameter of first wheel is double the length of the crank.

E. O. L. asks: What is nitro-glycerin composed of? Answers: The wonderful explosive termed nitro-glycerin is composed of nitric acid, sulphuric acid and glycerin. It is made by mixing together equal parts of the above acids and adding glycerin to the mixture, to the extent of one sixth of the weight of the acids. Precautions to prevent explosions are required in the manufacture.

M. A. asks how to manufacture paraffin. Answer: You can procure paraffin at the drug stores. It is made from wood tar, which is distilled, and the thick portion remaining is placed in hot sulphuric acid which burns up nearly everything except the paraffin. The latter is then pressed and purified. This is done by dissolving the paraffin in a hot mixture of alcohol and ether, which causes the deposit of the paraffin in beautiful flakes. Paraffin is also obtained from peat and from a soft coal found in Scotland.

C. F. asks (1) if there is any rule for lining up shafting from the main shaft to other parts of the mill. 2. Is there a rule for cutting belt holes through the floor? Answers: 1. With pieces of fine cord and a square, lines can be laid off, parallel or perpendicular to the line of the main shaft. 2. By making a diagram and finding the angle of the belt, the positions for the holes can be ascertained by using a string and a bevel.

M. H. asks: With 6 feet head of water, what sized turbine water wheel will be required to pump water through 1 inch pipe 1,500 feet long up to 100 feet elevation? What kind of a pump shall I use? Answer: It depends entirely upon how much water you wish to deliver per minute. That being settled, you can find the size of wheel required, by examining the circular of the water wheel builder. By consulting our advertising columns, you will find the names of pump makers, to whom you can write for further information.

M. M. asks by what process he can harden cast or German steel plow molds, ⅛ inch thick, to make them of even temper and as hard as possible. Answer: It will probably be difficult to harden the metal without retorts, but possibly the following method, if carefully conducted, will answer: Coat the metal with prussiate of potash, mixed with flour paste. When it is dry, cover it with clay to keep the potash from coming off, and heat to a bright red.

O. G. asks: 1. Is slaked lime injurious to a horse if sprinkled on the floor in his stall to keep or stop the bad smell that is in all stables? If so, what can I use in place of it? 2. I want a 2 horse engine that will burn wood or coal; whose make is the best? How much will such an engine weigh? 3. Iowa coal is $6 per ton, and soft wood is $3 per cord; which is the cheaper? 4. What book contains engravings of the latest and best electrical machines, for motive power? Answers: 1. Use chloride of lime or carbolic acid. 2. Consult our advertising columns for information as to makers of engines. An engine and boiler of 2 horse power will weigh from 1,300 to 1,800 lbs., and cost about $500. 3. Unless the coal is of unusually good quality, wood will be the cheaper fuel for you to use. 4. Noad's "Text Book of Electricity," Ganot's "Physics," and Silliman's "Principles of Physics," all contain illustrations of recent forms of electrical engines.

G. L. B. says: In my show windows, I have great trouble arising from damage to various kinds of goods exposed there. Iron or steel is quickly covered with rust, and brass wire or thin plate brass becomes almost as brittle and black as scorched paper. The windows are enclosed with glass, have but little sun, and appear to be tight. No gas is burned inside the case. Is there any way to prevent it? Answer: Try ventilation. Put a piece of stove pipe perpendicularly into the upper end of the window and burn a jet of gas in or under it to produce a draft. An opening at the bottom covered with gauze will admit air and keep out insects. Have you nothing but hardware in the window, and nothing to generate sulphurous fumes?

F. E. W. asks: How can I remove an old berry stain from a white dress? Answer: Try sulphurous acid.

A. & B. say: 1. A hires power from B; A is to have the use of a 6 inch belt to run on the pulleys as they stand. When A goes to work, the driving belt that is intended to drive the 6 inch belt runs off the pulley, which leaves A without power. A claims that B has not got sufficient power in that driving belt to give A the use of the 6 inch belt, or it would not run off the pulley. B says that A takes more power than the 6 inch belt will drive. A contends that, if he did, the 6 inch belt would run off the pulley, and the driving belt would stay on. Which is right by the law of mechanics? 2. B hires a so-called first class machinist. He takes down the 20 inch pulley and puts on an 18 inch; this, he claims, will give more speed, which will give more power. A claims that to increase the speed is to decrease the power. A does not want speed; he wants power. B then puts an 8 inch belt on the 18 inch pulley and lets it hang over 2 inches, and claims that A has more power. A claims that he has less power. A and B leave it to you to decide. Answers: 1. It is somewhat difficult to decide a question of this kind, without a personal examination, to render it certain that we are in possession of all the facts of the case. Your first statement is correct; if the driving belt slips off, it does not furnish all the power that could be transmitted by the 6 inch belt. In the second case, if, as we understand it, the changed pulley is the driver for your 6 inch belt, and if, with the present modification, your 6 inch belt is driven satisfactorily, you have more power than before.

S. A. H. asks us to state, briefly and clearly, what we understand by "Science," as used and applied in our publications. Answer: We will answer our correspondent's comprehensive question by a few quotations: "Science is applied to the knowledge of many, methodically digested and arranged so as to become attainable by one." "A science is a body of truths, the common principles of which are supposed to be known and separated, so that the individual truths, even though some or all may be clear in themselves, have a guarantee that they could have been discovered and known, either with certainty or with such probability as the subject admits of, by other means than their own evidence." "Science is applied to any branch of knowledge which is made the subject of investigation with a view to discover and apply first principles."

D. C. asks: 1. What percentage of power has ever been developed with rotary engines, compared with other kinds? 2. Can perfect condensation be secured by any means now in use? 3. What is the relative advancing power of a locomotive when the connecting rod is at each of the four cardinal points of the circle? Answers: 1. We have never seen reports of any careful tests of the performance of rotary engines. 2. No, if you refer to the production of a perfect vacuum. 3. At top and bottom, the full power of the engine, multiplied by the sine of the angle between the connecting rod and the crank, is exerted; at the other two points, no power is imparted by the engine.

W. P. asks: 1. How can I set a plain slide valve of a stationary horizontal engine (so as to cut off at any given point), without removing the steam chest? 2. What ingredients can I use to stop the foaming in my boiler? Answers: 1. It can only be done by making a diagram, or model to scale, knowing the size and position of ports, etc. You will find plain rules in "Link and Valve Motions," by W. S. Auchincloss. 2. If the foaming is caused by insufficient steam room, no ingredients will have any effect. Carrying a higher pressure of steam, if your boiler will safely sustain it, may remedy the trouble. If it is caused by dirty water, frequent blowing off will be advisable.

A. Y. S. says, in reply to the question of the advisability of having fewer teeth in a saw: I would say yes, for two reasons; the first is that, having more room for sawdust in the cut, power is saved; the second is that it takes less power to cut one eighth of an inch with one tooth than it does to cut it with two, for the front cut of one tooth is the same in both cases; and if the side cut were the same in both, one tooth would take but half the power. But if it is twice as great (and it cannot be any more), we have a saving of one front cut.

A. S. says, in answer to G. F. C. who asked for a description of the electro-plating process of Professors Jacobi and Klein: Professor Jacobi states that deposits of nickel can be obtained just as well from other double sulphate of nickel salts as from the sulphate of nickel and ammonia. He remarks further that the deposition of nickel succeeds far better by the application of an anode made of pure nickel, than by the saturation of the solution with soluble double sulphate of nickel and ammonia, etc. Professor Klein says that, in the Imperial printing establishment, the process of Becquerel (published in 1862 in *Comptes Rendus*) is applied, namely: a solution of a double salt of nickel and ammonia, modified by the insertion of a nickel anode. There is no necessity of particular care or precautions for avoiding the presence of traces of alkali in the solution; on the contrary, experience has proved that regular deposits will be obtained from solutions containing considerable quantities of sulphate of potassa or sulphate of soda. See "Business and Personal" column in this issue.

C. A. says, in answer to E. F. C.'s question for something that will prevent rats from gnawing his bellows: Skunk's oil is the only preventive I have ever found, and I have perfect confidence in it for the above purpose. It is perhaps scarce and hard to obtain, owing to the disagreeable smell while rending it from the animal's flesh. But I feel justified in recommending it for the above purpose. It not only prevents rats and mice from gnawing bellows, but its use ought to be apparent to careless farmers, who often leave their harness, saddles, etc., wherever they use them last. Skunk's oil is a sure remedy in all cases, as no animal will chew or gnaw leather where it is present, and it is not disagreeable to the user. It has little or no tendency to rot the material on which it is used.

F. A. M. says: In reply to A. H. G.'s query about his water not rising in the morning to the same hight in a gage as it was at night, I will suggest that there is distillation along the pipes between the boiler and the engine.

R. B. V. replies to E. W. H.'s problem: I would say that such a body could not receive momentum because it is without weight. If struck, the whole body would move in the direction of the force; for being weightless, it has no gravity.

H. P. M. writes as follows: In reply to W. F.'s question about a mixture for facing castings, I would say: For a casting weighing 800 lbs., and 3 inches thick, take new molding sand, 5 shovelsful, dry old molding sand, 3 shovelsful; mix thoroughly and then add 1 shovelful sea coal facing (pulverized Cumberland or bituminous coal, according to locality); mix well and riddle through a fine sieve, then dampen, and riddle on your pattern. The lighter the casting is to be, the weaker you must make your facing; for a plate ½ an inch thick, 1 shovelful of coal to 12 of mixed sand will do; if the casting is only ¼ inch, 1 to 15 will be right, instead of 1 to 8 as above. In casting a thin plate, I never put any facing on the cope side; then, if you want to "slick" the mold, shake on a little plumbago, and "slick" with your tool. On a very heavy casting, use a facing of 1 shovelful of coal to 5 or 6 of sand. If the facing be too strong, the casting will look cloudy or wormy. To make black wash for a dry sand mold, put 2 or 3 handsful charcoal in a dish or pot and add clay wash that has been strained until the whole will be so as to drip off your finger nail and leave a coating; or use molasses water instead of the clay wash, putting the black wash on with a fine brush, then "slick" with your tool. If there are cracks in your dry sand mold, fill them up with a putty of charcoal and oil.

F. A. M. replies to J. V. D.'s query for a stain to imitate rosewood: First rub the wood with vinegar in which old nails or iron filings have lain for 5 or 6 weeks; then streak it with extract of logwood. The success of the imitation depends on the skill of the operator.

H. M. W. says: In reply to C. R., who asks respecting Pharaoh's serpents, you give him the original and poisonous form. The *Pharmacist* (Chicago) 1871, p. 229, contains the following harmless substitute, by Puscher of Germany: Bichromate of potassa two parts, mixed with saltpeter one part and sugar three parts. Press into a tinfoil cone, a little open at top.

J. D. T. says, in reply to J. H. W.'s query about the hydrometric strength of dilute spirits: If we add 100 gallons of water to 10 gallons of proof spirit, the liquor will be 50° under proof, or 25° (real strength) by Tralles' hydrometer; and its specific gravity would be ·97087, provided no contraction took place. To allow for this contraction it will be necessary to add, to 100 gallons of spirit at proof, 100·7 gallons of water. The two numbers added together 100+100·7=200 gallons spirit 25° by Tralles; specific gravity would be ·97087. In answer to question: How many gallons of water are required to reduce 100 gallons of spirit at 60° above proof to a spirit 20° below proof? By volume it will require, to reduce 100 gallons of spirits 60° above proof to 20° below proof, 100 gallons of water. But there would not be 200 gallons of the new compound, owing to the contraction which takes place when alcohol and water combine. In order to allow for the contraction, the spirit must be reduced by weight or specific gravity. For reducing 100 gallons of spirit 60° above proof to 20° below proof, 1 4 gallons of water are required. The two numbers added together, 100+104=200 gallons of spirits at 20° below proof. It will be noticed that 204 gallons of fluid have been used, yet the product is but 200 gallons, showing a contraction of 4 gallons. 100 gallons of spirit at 60° above proof, and 100 gallons of water will not make up 200 gallons of the new mixture; they will yield but 196·15 gallons. But the strength will be rather higher than 20° below proof. In answer to the question: How many gallons of spirit at 60° below proof will it require to reduce 40 gallons of spirit of 90° above proof to a spirit at proof? Forty gallons of spirit 90° above proof, added to 60 gallons of spirits 60° below proof, equal 100 gallons of spirit at proof. Thus:

40 gallons 90° above proof contains.....76 proof gallons.
60 " 60° below " " .....24 " "
100 gallons at proof. 100 proof gallons.

J. D. T. says, in answer to J. H. R.'s query as to measuring the contents of a partly filled cask: Instruments called wantage rods are kept by nautical instrument and hydrometer makers, and are used by liquor dealers. By the use of them, the contents of a package partly full can be ascertained, provided the full capacity of the cask is known; if not, the package must be gaged, after which the wantage rod is used to find the deficiency.

R. J. H. says, in reply to J. J. P., who says that his telegraph line of 200 yards length won't work: In case of the absence of gas or water pipes or a pond, the trouble can be remedied by using a metallic circuit, that is, put up another wire on the same poles or supports, insulated from the first wire; this is the proper way to do it. Short circuits cannot be worked successfully in connection with the earth; it is a very popular fallacy to suppose that the earth acts as a return conductor; the earth merely acts as a condenser or reservoir, and a battery is merely an apparatus for drawing electricity out of the ground in one place and forcing it in at another. When these points, ground plates, are very near each other, the battery force required is as much as if they were a great distance apart. There is probably another difficulty with his line, and that is in the sounders themselves; but as no number or diameter of wires is given, I cannot tell him how to remedy it; but I will quote the fundamental rule of practical line equipment, namely: The maximum magnetic or working strength is obtained when the sum of the resistance of all the magnets is equal to the resistance of the rest of the circuit; that is, in this case, the two magnets must have a resistance equal to the line wire and the battery, and it is not probable that such is the case, if they have only 20 feet each. In the absence of apparatus for electrical measurement, J. J. P. can only get at a mathematical conclusion by reference to tables giving resistance of wires by their size or diameter, which he will find in any standard work on practical telegraphy.

R. H. A. says, in reply to many queries in reference to sharpening old files: The difficulty, and the only one, seems to be this, that the action of acid reduces the acute angle, which the cutting point of the tooth needs, to an obtuse angle, like that of a squared tap; and the file has none of the means of force which render a blunt tap effective. To illustrate, we suppose a file tooth to be in section like a V; the acid acts on one side and in the groove between the teeth equally. If this V is an angle of about 60°, it will be seen, by any one who chooses to prove it, that the first cut of the acid, or the action on one side only, has lowered the point of the tooth double the distance of the depth of the perpendicular cut; and when the effects of the acid on both sides of the tooth are combined, the best result will be a right angled edge or point. In the grooves, the acid has a far greater surface, proportionally, to act on, and becomes rapidly saturated, while at the points the reverse is the case. Now if, after rendering the file chemically clean, as is requisite, a delicate touch of resisting matter could be applied to the points of these teeth, the acid action would be retarded until enough metal had been removed from the grooves to render the process successful. It would need care and tact to accomplish it, but I believe it may be done. Perhaps if an accurately round rubber roller were very slightly greased with tallow and passed over the file after the manner of the printer, or if native rubber were dissolved in bisulphide of carbon and instantly used, the experiment might be successful; it would depend on the skill of the operator. The acid would certainly have to (and would) creep under, and would not go through, the protecting substance, giving time (which is always an element in chemistry) for prolonged action in the grooves, before the points become sharpened, without reduction of length.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Retardation of the Earth by Tides. By O.

On the November Meteors. By D. K.

On Cleansing Incrusted Boilers. By T.J.A.

On a Refractory Silver Ore. By P. S.

On Iron Tie Rods. By E. M.

On the Spleen and Electricity. By S.W.J.

On Corundum in Pennsylvania. By J. L.

On the Million Dollar Telescope. By S.H.M. Jr., and by F. D. J.

On Professor Haeckel on Embryology. By A. M. W.

On the Bodies Associated with Biela's Comet. By D. K.

On Industrial Education. By S. C. Armstrong.

On a Cheap Fire Alarm. By A. N. J.

Also enquiries from the following:

A. G.—E. L. E.—W. H. S. & Co.—M. C.—D. C.—J. W. H.—P. K. F.—P. C. B.—B. W. C.—W. McC.—W. S.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

MINERALS AND FOSSILS.—Specimens have been received from the following correspondents, and examined with the results stated:

A. H.—You are partially correct in your conjectures. The most interesting of your specimens is No. 6, which is a *spirifer granuliferus* from the Hamilton group The organic matter and lime have been leached out, and only the earthy matter remains, which is, in this case, fine grained sandstone. You will find this species fully described in Dana's "Geology." No. 3 contains iron pyrites; the black streaks are impressions of plants, and are insufficient to determine what species the plant belonged to. It is probably from the Hamilton group. Will you please inform us in what county of New York these specimens were found? No. 2 is only quartz, as you say.

L. F. I.—An argillaceous yellow ocher; it would doubtless answer for a cheap paint.

[OFFICIAL.]

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WERE GRANTED FOR THE WEEK ENDING

May 27, 1873,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

25,183.—NAIL MACHINE.—D. Dodge. August 6.
25,235.—MANUFACTURE OF IRON.—B. Lauth. August 6.
25,239.—ELASTIC HOSE TUBING.—J. C. Boyd. August 13.
25,309.—NAIL MACHINE.—D. Dodge. August 13.
25,344.—WIRING JOINTS.—A. C. Mason. August 20.
25,473.—SCALES.—A. Turnbull. August 27.
25,570.—CAR COUCHES.—E. C. Knight. September 10.

EXTENSIONS GRANTED.

24,161.—PLATFORM SCALE.—F. M. Strong, T. Ross.
24,182.—CHANNELING BOOT SOLES.—M. Wesson.
24,199.—GAS REGULATOR.—E. H. Covel.
24,200.—HYDROCARBON VAPOR APPARATUS.—E.H.Covel.
24,227.—CULTIVATOR.—R. M. Melton.
24,257.—CAR SEAT AND COUCH.—T. T. Woodruff.

DESIGNS PATENTED.

6,651 & 6,652.—STOCKING FABRICS.—M. Landenberger, Jr. Philadelphia, Pa.
6,653 & 6,654.—CARPETS.—A. Heald, Philadelphia, Pa.
6,655.—CARPET.—C. A. Righter, Philadelphia, Pa.
6,656 & 6,657.—FLOOR CLOTHS.—C. T. and V. E. Meyer, Lyon's Farms, N. J.
6,658.—CHAIR FRAME.—B. J. Harrison, New York city.
6,659.—STOCKING FABRIC.—M. Landenberger, Jr., Philadelphia, Pa.
6,660.—CAPE.—M. Landenberger, Jr., Philadelphia, Pa.
6,661 to 6,662.—FLOOR CLOTHS.—C. T. and V. E. Meyer, Lyon's Farms, N. J.
6,664.—STOCKING FABRIC.—J. W. Parks, Philadelphia, Pa.
6,665 to 6,672.—STOCKING FABRICS.—C. Button, Philadelphia, Pa.
6,673 to 6,676.—SCARVES.—C. Button, Philadelphia, Pa.
6,677.—ORGAN BASE.—L. K. Fuller, Brattleborough, Vt.
6,678.—ORGAN CASE ENDS.—L.K. Fuller, Brattleborough, Vt.
6,679.—ORGAN CASE.—S. Hayward, Boston, Mass.
6,680.—ORGAN CASE ENDS.—S. Hayward, Boston, Mass.
6,681.—CAPE.—M. Landenberger, Jr., Philadelphia, Pa.
6,682 & 6,683.—FLOOR CLOTHS.—J. Barret, New York city.
6,684.—SLATE FRAME.—J. M. Coffin, Danielsville, Pa.
6,685.—COOK STOVE.—R. R. Finch, Peekskill, N. Y.
6,686.—BRACKET.—A. D. Judd, New Haven, Conn.
6,687 & 6,688.—CARPETS.—H. S. Kerr, Philadelphia, Pa.
6,689.—STOCKING FABRIC.—M. Landenberger, Jr., Philadelphia, Pa.
6,690.—SODA APPARATUS.—J. F. Meacham, Newton, Mass.
6,691.—FLOOR CLOTH.—J. Meyer, Lansingburgh, N. Y.
6,692.—COOK STOVE.—J. Peckover, Cincinnati, Ohio.
6,693.—MONUMENT.—J. Sharkey, Brooklyn, N. Y.

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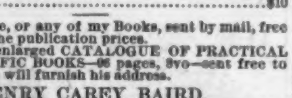

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